BELL LABORATORIES RECORD

INDEX

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BELL LABORATORIES RECORD

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Bell Laboratories and the War

THE importance of electrical communication in war and the importance of Bell Telephone Laboratories in those arts of communication were manifest in the First World War. The Laboratories, at the time operating as the Engineering Department of the Western Electric Company, made several important contributions to the war effort of the United States. First was its contribution to the facilities and services which Bell System Companies provided during the hectic years of 1916-1918, when munitions plants boomed in cities where normally telephone traffic was relatively light and when Army camps and Navy stations arose in widely separated and almost uninhabited sections.

Only a couple of years earlier the Laboratories' research program had resulted in extending the possible range of telephone service to transcontinental distances. Vacuum-tube repeaters and circuit arrangements which were developed for the first transcontinental line were rapidly applied to improving the quality of telephony and increasing the distance over which it was possible. The 1915 transoceanic experiments in radio telephony, from Arlington, Virginia, to Paris and from Arlington to Honolulu and Panama Canal points, developed principles which were applicable immediately to wartime problems of radio telephony.

The vacuum tube had also been put into service in 1917 in an experimental carrier current system for multichannel transmission over wire circuits. Carrier current telephony, because it permitted three or four additional messages to be transmitted over the same pair of conductors, proved of great value in meeting the sudden demand for additional facilities between cities of importance in the wartime program of munitions production.

Because of its background of experience and techniques and because of its highly trained force of scientists, engineers and technicians the Laboratories (*i.e.*, the Western Electric Engineering Department) was called upon to make many developments for the Signal Corps and for the Navy. A prominent outgrowth of this back-

ground of knowledge was a radio telephone system between ground and airplanes in flight—first demonstrated to the Army at Wright Field in August, 1917.

The arts of electrical communication are adaptable not only to communication between human beings but also to communication between man and machines, or between machines and man. The remote control of a switching mechanism at a telephone central office which is accomplished by dialing is an illustration of a system for communication between man and machine. Another is the operation of a distant typewriter by what is typed at the sending station of a teletype system. Of the converse case, the most popular illustration is television where a mechanism scans a distant scene and re-creates it for an observer. In wartime all these varieties of electrical communication are important in military operations. There must be communication not only between the human beings who are engaged but also between these humans and machines. Mines, for example, are fired by remote electrical control. Information transmitted from machine to man serves to detect the presence of an airplane or of a submerged submarine. An unconscious communication from man to man is illustrated in the detection of miners and sappers by properly placed listening devices. Electrical systems for many of these types of military communication were designed in the Laboratories during the First World War. Important also in military operations is privacy or essential secrecy in communications between operating units; equipment and methods for sending coded messages were other outgrowths of the Laboratories' ingenuity and experience.

The personnel of the Laboratories also contributed individually to the war effort by volunteering for service, usually in the Signal Corps, because of their specialized training. The nucleus of the Division of Research and Inspection which the Signal Corps established near Paris was drawn from the Laboratories. Its officer in charge was the late Lieutenant Colonel Herbert E. Shreeve; and Major O. E. Buckley, who is now President of the Laboratories, was in charge of its Research Section.

Now, in this World War, the Laboratories is again called into action for the assistance of the military forces. The problems presented to it are of the same general type as before. The Laboratories must develop improved communication facilities for Bell System Companies; and it must develop or improve a wide variety of specialized systems for military communication. The armed forces, whether on land, at sea or in the air, must communicate between their various units and with their bases and with their Government headquarters. This communication must be rapid, reliable and highly secret. There must also be communication between their mobile units, between tanks, airplanes, ships or submarines; and there must be machine-to-man systems for communication which can be used to detect and localize those of the enemy. The speeds, however, with which these vehicles can move are today many times what they were in the first war—a result, of course, of the general advances in scientific knowledge.

Correspondingly more difficult, therefore, have become the problems of detection and localization and of communication in general. On the other hand, the art of electrical com-

munication has advanced during the past two and a half decades, fully as rapidly as the other arts which are of service in wartime. Its apparatus and techniques are today far superior to those in the earlier war. The Laboratories today is an organization with a long and successful background of experience and it now has more scientists and engineers with a broader overall range of scientific and engineering abilities. It has a larger force of draftsmen, mechanics, instrument makers and other technicians. The experience of its entire force, men and women, is greater and their individual abilities certainly no less than in the earlier conflict. And their loyalty and determination to do their utmost in this national emergency are deep seated and strong.

In the present World War the military problems on which the Laboratories works come to it from several sources. First is the National Defense Research Committee. This organization was created by President Roosevelt in 1940 with authority and funds to promote researches of importance in the program of national defense. Its membership includes representatives of the Army and of the Navy and leading research men from universities and industrial laboratories. One of its eight members is Dr. F. B. Jewett, Vice-President of the American Telephone and Telegraph Company. On some of its subcommittees are members of the Laboratories.

The N.D.R.C. farms out to academic or industrial laboratories various research problems which its experts feel might lead to military equipment of great value in the present struggle. Its program was well under way by the time of Pearl Harbor and it had started on a large variety of military problems. Over thirty of its communication projects had been assigned to the Laboratories under contracts made with the Western Electric Company and were progressing rapidly. By the middle of 1942 the number of projects assigned to the Laboratories had increased to over a hundred and twenty-five.

The peculiar advantage of the N.D.R.C., as an organization, lies in the fact that it allows our Government to do, in the broad field of military arts, the same sort of thing that the Bell Telephone System has done for years in the communication arts. In our System, the American Telephone and Telegraph Company supplies funds to the Laboratories for work basic to the electrical arts of communication. In carrying this out, fundamental research work is undertaken but nobody knows what, if anything, of value will come from any particular research; however, from past experience everyone knows that some new principles, devices, discoveries or inventions will arise and that in time most of them will lead to useful developments and equipment. After the equipment has been designed it can be specified to the Western Electric Company for manufacture. And after that company has decided on the most economical process of manufacture, the Operating Companies of the System can be advised of the availability of certain types of equipment adapted to certain functions of communication.

Through the N.D.R.C. that sort of flexibility becomes possible to a larger extent in Government operations. The Army and the Navy, for example, under the law must buy equipment on a specification basis, suitable for bids by one or more manufacturers. In other words, they must be able to describe concretely what they wish to buy. Because the results of

research are unpredictable they cannot buy research services that may or may not develop something to fit their immediate problems. They cannot directly contract for the exploratory pioneering work of research upon which important but unforeseen developments can later be based. The organization of the N.D.R.C., however, permits exactly that desirable operation. It can start research projects, drop them if unfruitful and follow any leads they develop. And through the Army and Navy representatives on the committee the various research programs can be chosen with reference to military necessities. When a project has led to principles, devices or techniques that can be embodied in apparatus of probable military value, the Army or the Navy comes more formally into the picture. They can then introduce their additional technical requirements and contract in the usual way for the manufacture of the apparatus which the research has projected.

The Laboratories is working on a considerable number of apparatus development projects of this character, under contracts made by the Western Electric with the Army and the Navy. There are some contracts covering equipment and devices that have derived from the Laboratories' continuing development work and have been found to be of military value. That is particularly true of radio telephone systems where the Laboratories has long been in the lead. Also, there are many contracts covering developments which have arisen entirely from the requirements of the Army and the Navy and on their direct orders.

All of these military developments are necessarily secret and confidential. Information as to what they are or as to the techniques and devices they employ would be all too valuable to our enemies. Each technical group in the Laboratories, therefore, keeps to itself the information as to the projects on which it is working; or it releases to other groups which carry part of the work only information necessary to the successful accomplishment of their portions of the total task. This is the present necessity.

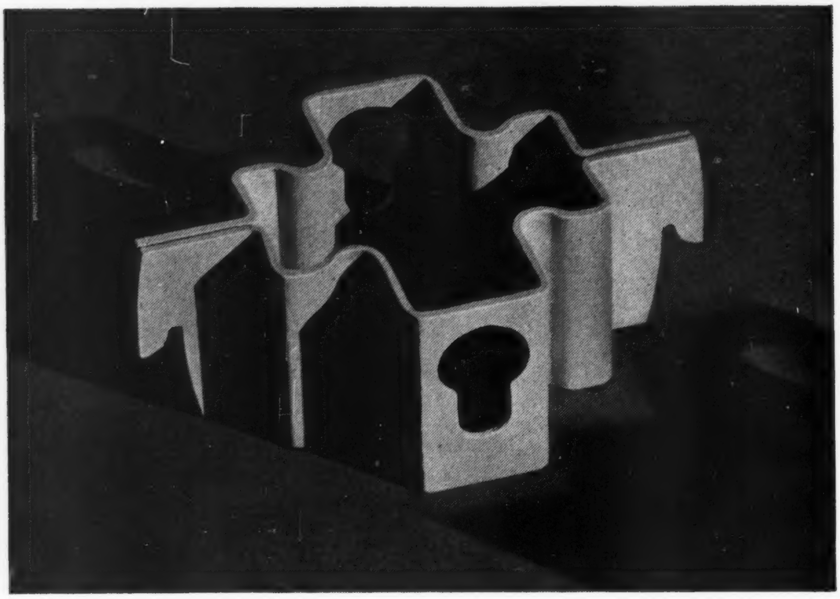
In that matter the Laboratories differs from manufacturing companies which are concerned with the production of military equipment. It is possible, for example, for workers in an airplane factory to tell their friends that they are working on airplanes—provided they give no indication of the output of their factory, or such details as the firing power or protective armor or flight-control instruments of the planes which they help to produce. A member of the Laboratories, on the other hand, must sometimes appear to his friends as not doing his part in this war for he can tell them no particulars of his work. About the most that he can tell them has been said in this article. He may not even know the function of the complete apparatus to which he contributes parts or its military significance. He is somewhat in the position of a secret agent who can admit nothing, may not even know the purpose of his mission nor how it fits in with those of other agents and with the plans at headquarters. That is the position of almost everyone in the Laboratories.

Those who are "in the know" on any military project and are devoting their full energies to it, can take it for granted that the other groups, as to whose work they are uninformed, are similarly employed on projects of importance. Those who assist the technical workers by service and supply,

those that do the clerical work, the accounting, shop work and building of models—all the others in the Laboratories organization—can assume that what they are doing is of vital importance. Some day the whole story can be told, but at present all the men and women in the Laboratories can feel sure that they are contributing importantly to winning the war, provided they do their work in the most productive and efficient manner possible.

In this war, as in World War I, members of the Laboratories are joining the Armed Forces. Both Army and Navy and the Selective Service, however, recognize the importance of scientific workers behind the lines. In the war ahead it may very well be that victory will be due not only to organized manpower and industrial facilities but equally to the genius of the scientists and engineers who devise the new tools of conflict. And for that reason the authorities have been unwilling that the work of the Laboratories should suffer too great loss in its technical personnel.

On the other hand, there are duties in the military forces for which the background and training of Laboratories personnel is peculiarly suited. The Laboratories has, therefore, cooperated with the Signal Corps by nominating, in response to requests, members of its personnel who would be best fitted for specified responsibilities. Through such voluntary enlistment and through calls upon reserve officers and under the Selective Training and Service Act, 182 men have gone into active service. In addition, nineteen have been loaned to the N.D.R.C., twenty-one others are spending part time on the section committees of the N.D.R.C., three are engaged in work with the Navy Department, one with the War Department and one with the War Production Board. The fact that the armed forces are taking men from the Laboratories because of peculiar expertness and giving them corresponding responsibility is indicated by their present military rank. In the Army the Laboratories has 7 Lieutenant Colonels, 21 Majors, 17 Captains, 22 First Lieutenants, 17 Second Lieutenants, 8 Sergeants, 5 Corporals, 56 Privates and 4 Aviation Cadets. In the Navy the Laboratories has 2 Lieutenant Commanders, 1 Lieutenant, 4 Lieutenants (jg), 4 Ensigns, 3 Petty Officers, 5 Seamen, 2 Aviation Cadets; and in the Marines 1 Second Lieutenant and 3 Privates. Three are Cadets in the U. S. Merchant Marine.



Partition Flexibility at Murray Hill

By J. G. MOTLEY
Construction Engineer

IN A large progressive organization, rearrangement of factory and office space is of frequent occurrence, and if partitions have to be moved, it is generally expensive as well. With a research and development laboratory, such relocations are particularly frequent because, instead of consisting of one moderately stabilized manufacturing procedure, the work is continually changing; different types of work requiring different space and equipment are of regular rather than of rare occurrence. In designing the Murray Hill laboratory, therefore, one of the major considerations was complete flexibility in the partitioning and services. It was desired not only to be able to provide laboratory and office space in almost any size needed, but to be able to make later changes and rearrangements quickly and economically. The solution finally reached was to have the basic building include no partitions except the side walls and those around the stair wells, toilets, and elevator shafts, and to use standard steel panels for all interior partitions. This would eliminate the dirty time-consuming procedure of subdividing space with masonry and plaster walls, and would drastically reduce the time required to make such subdivisions.

After an extensive study of various types of partitions, it was decided to base the design on the use of double-wall steel panels for all interior partitions and to use for the side walls and columns a single-wall steel wainscotting manufactured by Snead and Company. It was planned to run partitions under the floor beams for the most part, and a constant height is maintained between all floor beams and the finished floor to simplify their

relocation. The main buildings are 52 feet 8 inches wide inside with a central row of columns spaced twenty-four feet apart. Deep girders down the center of the building were avoided by running two shallower girders, one each side of the center row of columns. This had the additional advantage of providing a convenient space between the central girders in which duct work and large service risers could be run from cellar to attic. Windows are spaced on six-foot centers; and beams run from the piers between each pair of windows to the central girder on that side. The bottoms of these beams have been built at the same height as the central girders.

Except in those areas where the entire width of the building is to be used as a single room, a six-foot corridor runs down the length of each building on one side of the central row of columns. This provides rooms 27 feet deep on one side of the corridor and rooms 19 feet on the other side. The partition along one side of the corridor runs under one of the central girders; and to permit standard height partitions to be used for the other side, a false beam is run the full length of the building. Similar dummy beams are run at certain places in the office wing of the building and wherever an expected partition does not line up with the regular beams. Transverse partitions may be run under any of the floor beams; and individual rooms may be twelve feet wide or any multiple of six feet wider than this. This general arrangement is indicated in Figure 1.

The standard metal panels used are three inches thick and, except in a few locations, four feet wide. They are packed with rock wool to decrease the transmission of sound or heat. The sheet steel forming the two sides is coated on the inside with mastic material to deaden sound, and is stiffened by transverse members welded to the sheets on nine-inch centers. The support along the bottom is designed to form a double wire-way, which is reserved for telephone and signal wiring. Another wire-way is provided at the top, which is used for miscellaneous wiring, chiefly that for lighting switches. The panels are held in place by their two side members, and the adjacent panels effectively form posts which slide over punched steel pieces fastened to the floor between each pair of panels. At the top they carry a forked sliding plate that is

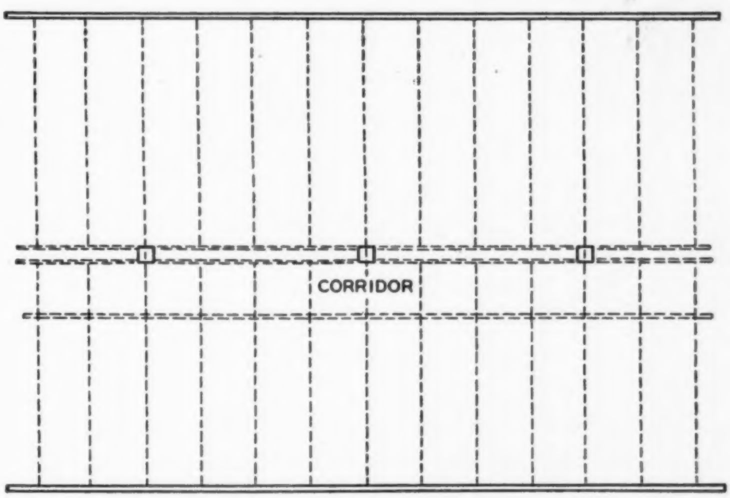


Fig. 1—Arrangement of beams and girders in a typical section of the main laboratory building. The central corridor down one side of columns is indicated. The central columns are spaced on 24-ft. centers and the rooms on one side of the corridor are 27 feet deep and those on the other, 19 feet. Transverse beams are on 6-ft. centers

pushed over a flange fastened to the ceiling. After the panel is in position this plate is locked in place by a wedge. This is shown in Figure 2. The panels have the sound-stopping value of a four-inch tile and plastered wall, and could obtain a fire underwriter's rating as a one-hour wall.

The floor plate over which the posts slide is designed to leave a three-inch space between panels; and a link plate—shown at the left in Figure 3—is slipped between the panels at about two-foot intervals and turned to lock

Fig. 2—Placing one of the steel panels in position in the Murray Hill Laboratories

them in place. These link plates have an open center to provide a vertical wire-way between panels. After these are in place, a cover plate, shown at the right in Figure 3, snaps over them and over the edges of the panels to complete the finished wall. Before the cover plate is put in place, however, the space between the panels is stuffed with rock wool. Flat metal finishing strips running the width of one panel are clipped in place without screws to cover the bottom and top wire-ways. Telephone terminal blocks are mounted concealed on the lower plates where the layout permits.

Along the outside walls, single-wall steel wainscotting is held far enough away from the brick walls to allow service pipes and conduit to run along the side walls under the windows and up the piers between them. This wainscotting also is coated with mastic on the inside and stiffened as are the double-wall partitions, and is similarly finished on the room side. The panels beneath the windows and up the piers are removable without special tools to give access to the various services. At each pier between windows a door is provided to give access to the 50-amp. circuit breaker on the power wiring or to telephone wiring, which runs up alternate piers. Immediately below the windows, two horizontal troughs are run: one for electrical wiring and one for signal wiring. These general arrangements are evident in Figure 4, left. Similar wainscotting is applied around interior columns, each of which carries a lighting cabinet on the corridor side. This is indicated in Figure 4, right.

Where transverse partitions abut the outside column enclosure, facilities are provided to permit the partition to be securely fastened to the wainscote. This same provision is

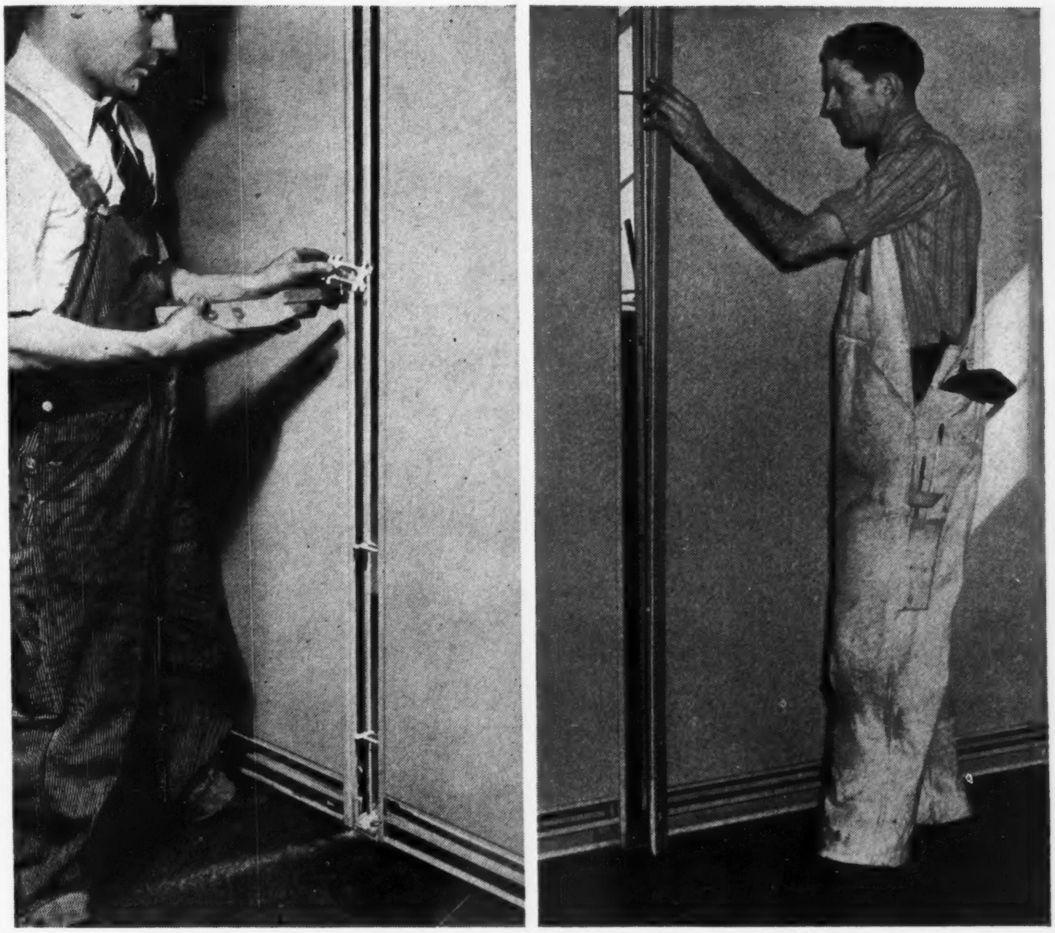


Fig. 3—At left, metal spiders hold the panels together and provide a three-inch vertical wire-way; at right, a cover strip encloses the space between panels

made at the columns at the center of the building for the corridor partition as well as for the transverse partition. Special panels with a removable top-filler section are provided to permit intercommunicating ducts to pass from one room to another, or for the installation of ventilating fans if a fully enclosed area such as a dark room or air-conditioned room is required. A special panel with an escape door located above normal position of services is provided in small chemical laboratories where a secondary means of escape is desirable, thus avoiding the sacrifice of space for a standard door. The great majority of panels are four feet wide from center to center of posts. They are interchangeable with the standard door units which are wide enough to permit a standard 3-ft. x 5-ft. desk to be carried through without turning the desk onto its side.

By use of these standard panels and fittings and of a few panels of special width, the partition problem is very satisfactorily solved. A research laboratory, however, is much more than a room with four walls. It requires a wide variety of facilities such as compressed air, vacuum, oxygen, nitrogen, hydrogen, steam at several pressures, water, drain lines, as well as

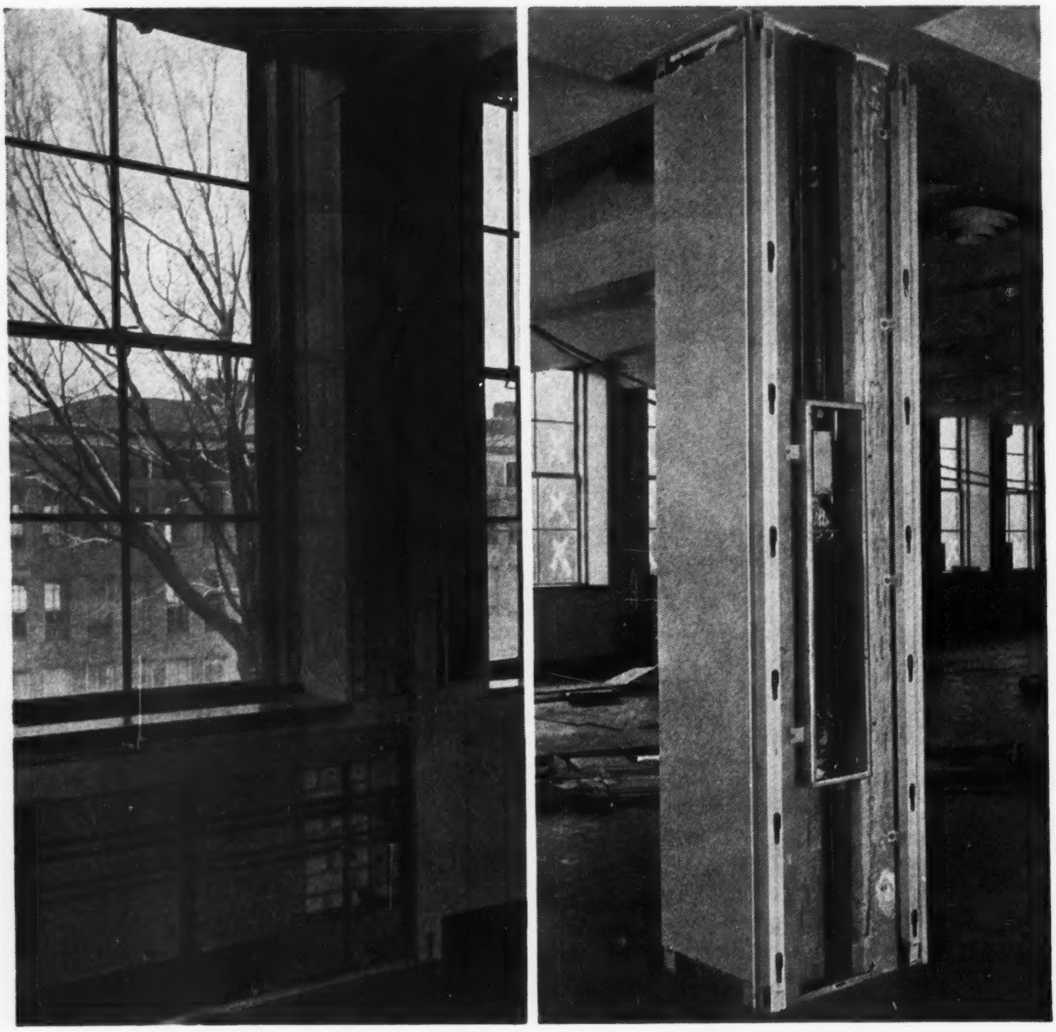


Fig. 4—Left, steel wainscotting on outer walls showing horizontal runs of piping beneath windows, the wire-way, and the door to give access to circuit breaker or telephone wiring. At right, single wall wainscotting around central column

power at different voltages and phases. In all, fifteen services are available at the Murray Hill laboratory with space provided for others if necessary. To get these from the side walls, where they run up from the cellar, means had to be provided for carrying them along the partitions. Supports cannot be screwed or nailed to a partition consisting of two thin steel sheets with nothing but rock wool between them, and, even if they could, it would be undesirable to do so because the simplicity of rearrangement, one of the major objectives sought, would be thwarted.

To overcome this difficulty, laboratory engineers, working with representatives of Snead and Company, developed a number of devices that permit piping, wiring, shelves, and almost anything that would conceivably be used, to be fastened to the partitions quickly and securely, and to be removed just as easily without marring the panels.

The basic unit of this system of supports is the steel fitting shown in

the photograph at the head of this article. In cross-section it is something like a maltese cross, and has two wings projecting from opposite sides. The end post strips of the panels are of heavier steel than the panels themselves, and are punched with narrow slots every six inches for the entire panel height. These slots are shown in Figure 2. After the panels are in place and locked together, these fittings are slipped in the vertical space between them with the two wings vertical. They are then turned to bring the wings into the slots in the ends of the panels and the fittings driven down. The design is such that the slots in the wings provide a wedging action and hold the fitting tightly to the panels. The keyhole slots in the two faces of the fitting provide the points of support for whatever is to be fastened to either side of the panels. The fittings may be readily removed by the reverse of the process for installing. Cover plates, used where these keyhole fittings are employed, have matching holes punched in them. Standard punched cover plates are provided for certain arrangements of services, but individual holes may be

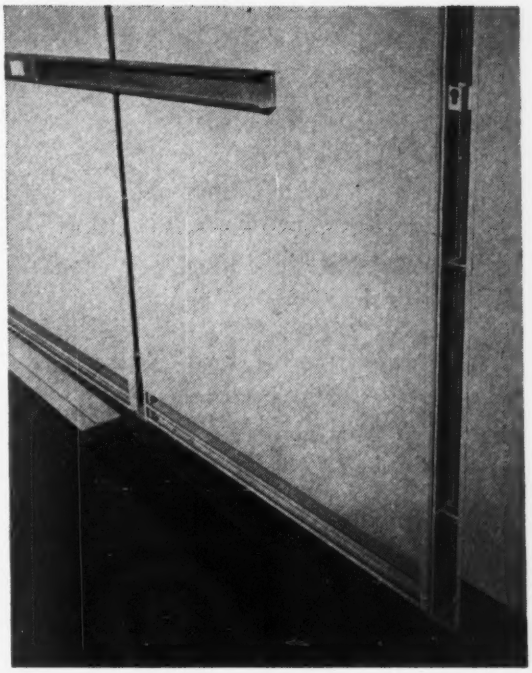


Fig. 5—Use of keyhole fitting to support horizontal wire-way

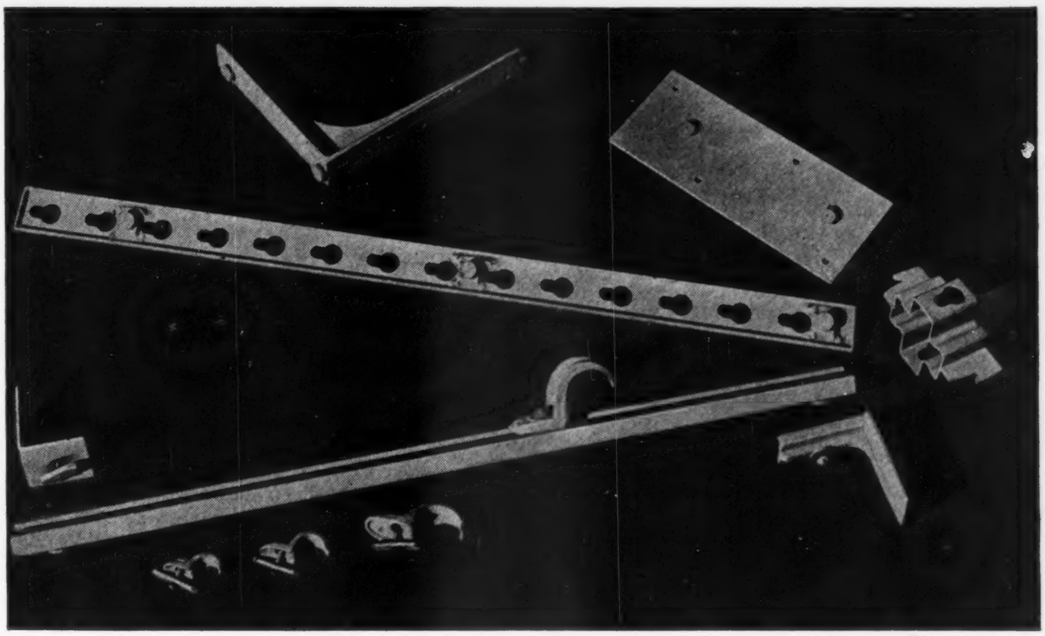


Fig. 6—Some of the special fittings designed as mountings on the steel partitions

punched with a hand tool if needed. Punched covers may be readily replaced by plain covers should the services supported by the keyhole fittings be removed.

The use of these fasteners to support a horizontal wire-way to a partition is shown in Figure 5. A single bolt and nut fastens it at each post. A nut has been designed with an arm on one side that enters the keyhole when it projects downward. When a bolt is screwed into the nut, the arm turns and holds against the side of the fitting while the bolt is tightened. Such bolts and nuts may be used, of course, to fasten anything desired to the posts. The most common needs, however, are for piping and shelving, and for these there were designed the long bars shown in Figure 6.

The pipe support, of two standardized lengths, is a narrow rectangular box with a slot down the front and two buttons on the back that slip into two keyhole fastenings as indicated in Figure 7A, and wedge tight as they are pushed down. Standard single-bolt

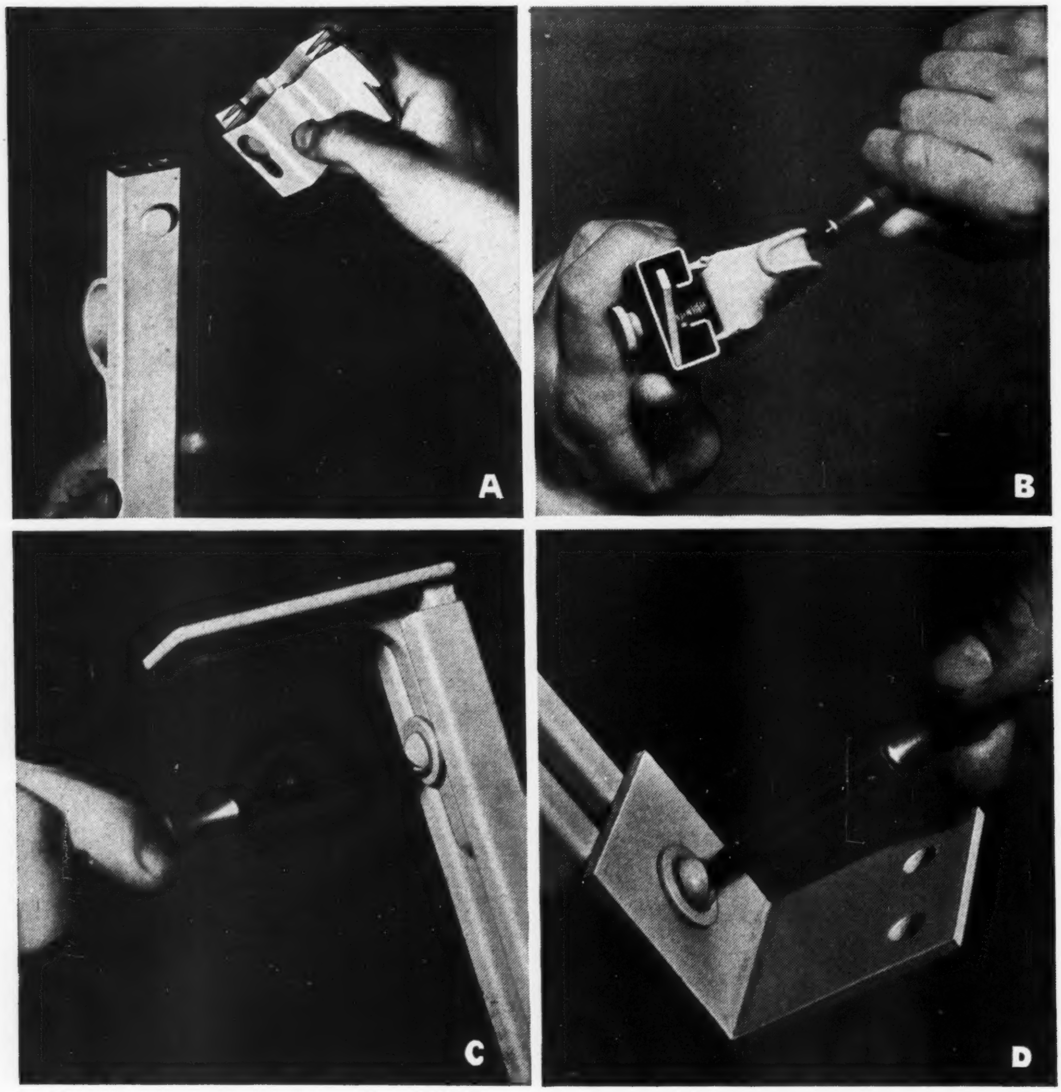


Fig. 7—Pipe supporting bracket

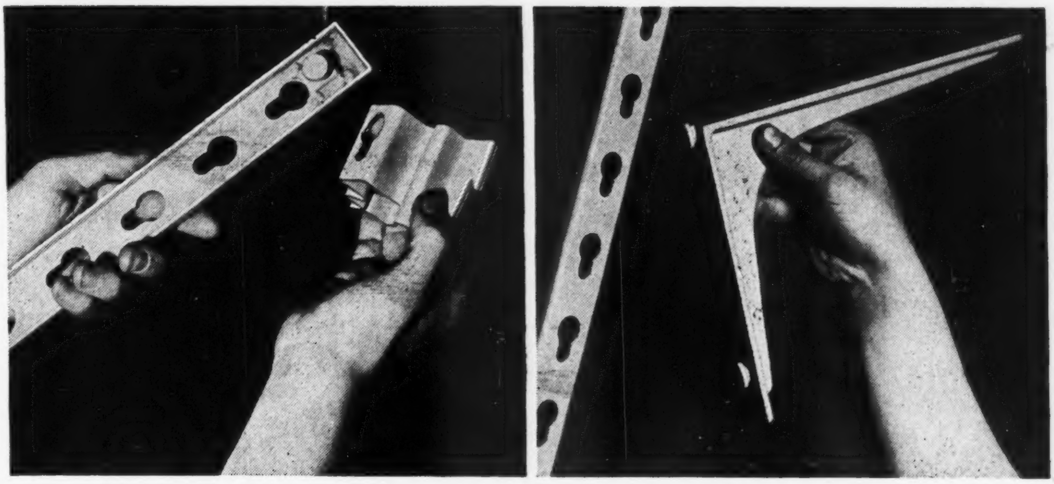


Fig. 8—Shelf supporting bracket

pipe clamps, Figure 7B, to hold piping to the racks, are fastened by a bolt and clamping nut similar to that described above. The continuous vertical slot permits adjustment for the pitch of pipes if they are to drain. Angle brackets, Figure 7D, have been designed for fastening to the pipe supports to hold a drain line which runs along the bottom of the support, and a wood shelf, Figure 7C, to support the cocks or valves for the various services. This bracket is designed to slide in the support from the top.

The other fitting, Figure 8, designed for shelf brackets, provides a series of keyhole slots two inches apart. Each bracket has two buttons that fit into the keyholes of the supporting piece and wedge in place. Typical uses of these devices in the laboratory may be seen in the accompanying photographs.

As already pointed out, the piping for the various services runs up from the cellar at the piers between the windows, and is then carried horizontally along the wall beneath the windows. Two methods are provided for getting the pipe out into the rooms. That most commonly used is to run along the interior partitions on the supports described above. A "shadow box," shown in Figure 9, has been designed through which the piping is brought out. This is merely a narrow slot with deep sides that hide the space behind the wainscotting except

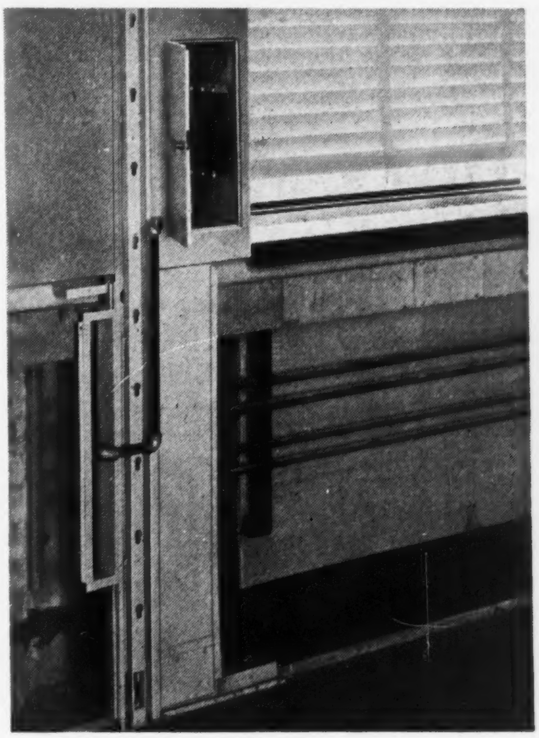


Fig. 9—Side wall showing "shadow box" through which pipe or conduit may be brought out

immediately behind the shadow box. Without these, the piping along the side walls behind the wainscotting would be visible from a wide angle in the room. The shadow box plate may easily be replaced with a plain plate should the service lines be removed.

The other method of bringing out service pipes is by trenches in the floor which extend eight feet from the outer wall as shown in Figure 10. These trenches which have been installed only where required are used principally in the chemical laboratories. They have waterproof covers, and special cover sections where the services turn up to service strips. Floor fittings have been provided for use where the piping turns up to an "island" bench.

With this partition panel and wainscotting, and the various fittings designed for fastening things to it, rearrangement of space and apparatus attains nearly ideal flexibility. Practically no loss of material is incurred in making changes because there is no marring or cutting necessary. All panels and supporting structures may be reused indefinitely. Occasional painting is all that is normally to be expected.

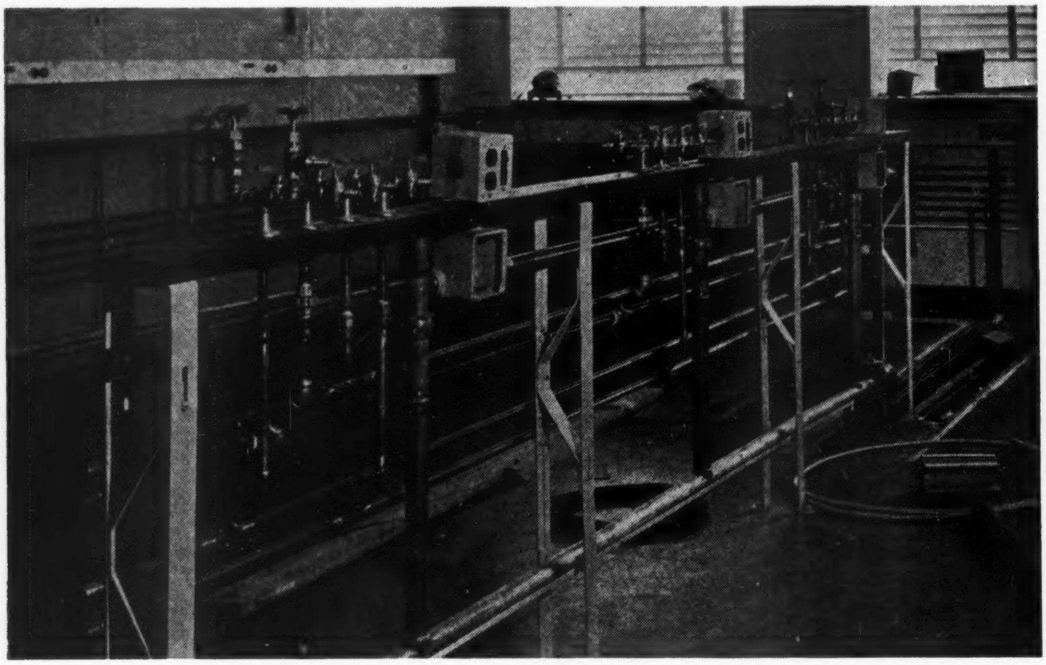


Fig. 10—One of the chemical laboratories showing floor duct for island services

News and Pictures of the Month

Western Electric Receives Army-Navy "E"

For "exceptional performance," the Army-Navy "E" has been awarded to all three works of the Western Electric Company. This recognizes the efforts of more war workers than ever before received this combined award of the two armed services. Formal presentation of the insignia took place in separate ceremonies during the last week of August.

In accepting the award, President C. G. Stoll stated that Western Electric factories are carrying heavy and increasing schedules of government orders for military communications equipment including field telephone apparatus, as well as radios for planes, tanks, artillery and torpedo boats and many other specialized devices. The output for the government during July of this year practically equalled its production during 1941.

In recalling Western Electric participation in former wars, Mr. Stoll disclosed that America had been at war with the Kaiser's Germany for barely a month when the Signal Corps handed Western Electric's Engineering Department, now these Laboratories, one of the most important tasks in the Company's history. The job: to give radio voices and ears to the fighting planes of World War I—and do it fast. Only three months later, on August 18, 1917, at Langley Field, Virginia, the now historic demonstration was staged of practical communication by radio telephone between a ground station and a plane in flight.

British Signal Commanders Visit the Laboratories

Three British Officers, representing the Signal Directorates of the Admiralty, the War Office and the Air Ministry, who are in this country at the invitation of Major General Dawson Olmstead, Chief Signal Officer of the Army, to inspect plants making signal equipment and Signal Corps installations and operations, were the guests of Dr. Buckley on July 31.

The officers were Brigadier R. F. H. Nalder, Deputy Director of Signals at the British War Office; Captain F. J. Wylie, Deputy Director of Signals of the British Admiralty, and Air Commodore O. G. W. G. Lywood, Director of Signals of the British Air Ministry. They were accompanied by Group Captain A. F. Lang, Royal Air Force; Squadron Leader F. Williams, Royal Air Force; Flight Lieutenant A. F. Lemmon; and H. G. Beer, British civilian.

Americans in the party included Brigadier General Roger B. Colton, Director of Signal Supply Service; Lieutenant Commander E. B. Patterson, Major P. E. Ketterer, Captain J. E. McCann, Lieutenant McCleary, F. Grubbs, civilian employee of the War Department; and William F. Friedman, Head Cryptanalyst, War Department.

Telecommunications Reports, in its July 30 issue discussing the visit of these British Officers to this country, quotes these officers as follows: "We believe we are one step ahead and we hope to stay one step ahead of the Axis nations in the 'radio war' and in the new techniques of communication and air raid detection." They were optimistic of the success of the United Nations in the "radio war" and particularly praised American equipment and techniques and stated that the importance of superiority in quality and quantity of radio and other signal equipment cannot be overemphasized because only relatively minor military engagements can take place without first-class communications systems and radio devices. They stressed that this was particularly true of air operations.

First Aid Organization for Air Raid Protection

At the West Street, Graybar-Varick and Davis buildings over two hundred members of the Laboratories, who have been trained and are qualified to give first aid, are organized into First Aid Squads. These squads are under the guidance of the Medical Department and under the direction of

Demonstrating the use of a Reeves stretcher to a group of First Aid Floor Captains at West Street. Standing, left to right: W. W. Schormann, E. C. Edwards, C. Erwin Nelson, W. S. Ross, F. B. Blake, Katherine Doring, J. H. Miller, E. J. Dahl, Margaret Portelroy, C. N. Anderson, C. B. Green and H. P. Smith. Kneeling, left to right: J. B. Worth, L. E. Coon, Ruth Robinson and J. S. Edwards. The "victim" is A. C. Holetz

J. S. Edwards, with L. E. Coon as alternate. The duties of these groups are to assist air raid wardens in evacuating designated areas and to render necessary first aid, including transportation to sheltered areas and whatever care is necessary thereafter.

A First Aid captain is in direct charge of each floor and has under him a sufficient number of squads for adequate coverage. These squads go to sheltered areas with the people on their respective floors. First Aid rooms have been set up in all sheltered areas. On each sheltered-area floor, squad leaders have been designated to take charge of these rooms and to direct reserve squads subject to call in an extreme emergency. The Medical Department on the fifth floor acts as the main casualty station.

News of Men in Service

Major W. K. St. Clair has taken over the supervision of the Auxiliary Corps Section which is planning Signal Corps requirements for Army Specialist Corps and Women's Army Auxiliary Corps personnel.

Captain John H. Bogle writes from the Medical Corps at Fort Snelling: "I am working on the Surgical Service at the Station Hospital here and keeping quite busy. I have also recently returned from a trip as Medical Officer with a large troop train from Fort Snelling to a Southern camp. This is a large reception center and the home of the Third Infantry, the oldest regiment in the United States Army."

Lieut. Louis T. Miller has been transferred to Napier Field, Dothan, Alabama. Lieut. Miller entered cadet training in March, 1941, and received his Wings and commission in October at Maxwell Field, Alabama, where he was stationed before he was assigned to the Advanced Flying School at Napier Field as an instructor.

Members of the Laboratories who have been granted leaves of absence to enter military service since those noted in the last issue

First Aid Captains for Air Raid Precaution System

West Street Buildings

E. J. Ball, basement	I. V. Williams, fifth	W. S. Ross, tenth
F. W. Seibel, first	C. E. Nelson, sixth	P. B. Findley, eleventh
J. B. Worth, second	F. B. Blake, seventh	R. L. Shepherd, twelfth
H. P. Smith, third	C. N. Anderson, eighth	H. V. Wadlow, thirteenth
W. W. Schormann, fourth	L. C. Wescoat, ninth	A. C. Holetz, building R

Graybar-Varick Building

F. B. Combs, sixth	A. D. Hargan, ninth	L. S. Inskip, twelfth
R. M. Hawekotte, seventh	R. Pope, tenth	R. Pope, thirteenth
N. C. Olmstead, eighth	J. M. Dunham, eleventh	L. S. Inskip, fourteenth

Davis Building

W. M. Hill, twelfth	T. M. Benseler, thirteenth	A. E. Ritchie, fourteenth

of the Record are: Lieut. A. Eugene Anderson, Edward J. Bybel, George J. Langzettel, Herman E. Manke, Armin J. McNaughton, John J. Moloney, John E. Paplin, Thomas G. Woods and Edward J. Yastremski; naval service, Robert Angle and Perry R. Brockett; the U. S. Marines, Richard C. Fiala and John C. Ptacek; and the War Department, Washington, Charles A. Parker.

Lieutenant Bertram M. Froehly, with a bombing squadron in England, writes: "I was fortunate to be in the first United States combat unit ever to be here. Everything is fine except that the telephone service is not quite what I'm used to."

D. L. Viemeister, Radioman 2d Class on U.S.S. *Idaho*, writes: "We have several pieces of Western Electric apparatus aboard ship and the maintenance of this and other equipment falls upon our group. The instruction I received at the Laboratories has aided me considerably in this work. I am still fortunate enough to receive each copy of the Record regularly. My copy is read by a good part of the matériel staff aboard ship and my division officer several days ago borrowed the Record and found it very interesting."

Recent Changes in Provisions for Military Leave

Women members of the Laboratories who enter upon active duty with either the Women's Army Auxiliary Corps or the Army or Navy Nurse Corps will come under the provisions currently in effect covering absence due to active duty in the military or naval forces of the United States.

Men who after induction into the Army receive a furlough to adjust their personal

First Sergeant William G. Pimpl is now "flying the balloons" with the Coast Artillery in California. This photograph was taken at the time he was Technical Sergeant at Camp Tyson, Tennessee

Courtesy The Pullman Company

affairs will have their leave of absence made effective as of the date of reporting to the Reception Center at the expiration of the furlough.

Absence from work at the Laboratories during the furlough period is regarded as "absence for personal reasons."

Service Men and Insurance Premiums

By Lloyd H. Bunting
Insurance Counselor

With so many members of the Laboratories going into military service, a great many questions have been asked of me about life insurance premiums. While a personal interview with your insurance counselor is essential, here is a brief statement:

1. Arrangements can be made with the government for monthly deductions from Army or Navy pay for insurance premiums.

2. Premiums may be paid annually in advance. If convenient, they also can be paid for five years in advance at a discount. If possible, give your insurance company a permanent home address.

3. A loan may be obtained from the government to keep in force as much as $5,000 of insurance, the loan to remain in effect for the duration and for six months after peace is declared. Funds to repay the loan will be deducted from the proceeds of the policy should the policyholder's death occur before repayment. A government loan is not made on a policy against which more than 50 per cent of the cash value already has been borrowed at the time the application for such a loan is made.

4. A loan to pay an annual premium also may be obtained from your insurance company.

5. A man entering military service can take paid up or extended insurance on existing policies.

6. He can take out up to $10,000 of government (national service) insurance.

7. Before dropping old policies, careful consideration should be given to possible losses which might result from giving up valuable features of the policies.

I shall be glad to discuss these or other matters concerning insurance.

Delivery of War Bonds

"Why don't they send me my bond? My last payment was two weeks ago and I haven't received it yet."

That's a fair question. Here's the answer. At the end of each month there are bought from the Federal Reserve Bank all the bonds which have been fully paid for by allotments during the month; and the bonds are then delivered as soon as possible. During May payroll deductions bought 3,199 bonds; during June 3,351; and during July 4,842. In addition almost 2,000 changes in subscriptions were taken care of each month.

No matter when delivery is made, each bond is dated as of the first of the month in which it became fully paid. For example, if an allotment finishes paying for a bond on August 27, the bond is dated August 1 and draws interest from that date, even though it is not delivered until late in September.

The work of handling the bonds can be carried out most economically on a monthly basis rather than on a weekly basis. At present this work takes the full time of four men and women; and the cost is part of the Laboratories contribution to the Bond Campaign. Coöperation and forbearance on the part of members of the Laboratories by not expecting their bonds until a month later than they are paid for is also a contribution to the Bond Campaign.

News Notes

O. E. Buckley has been reëlected Member-at-Large on the Engineering Foundation Board with a term that will expire in October, 1946.

The Kelvin Lecture, which Dr. Buckley presented *in absentia* to the Institution of Electrical Engineers last spring, carries with it an honorarium in the sum of £25. When that sum was tendered Dr. Buckley by the Institution, he suggested that the money be donated to some war charity of its own choosing. To this the Secretary replied:

"The Committee desire me to thank you most cordially for this generous gesture on your part and they have decided to present the honorarium of £25 to the Red Cross Society for the purchase of technical books on electrical engineering for prisoners of war, the books to deal with tele-communications subjects. The Committee feel sure that this will meet with your approval."

Dr. Buckley's paper, *The Future of Transoceanic Telephony*, delivered as the 33d Kelvin Lecture before the Institution of Electrical Engineers, was excerpted at length in *Nature* for July 11. An article by N. V. Firth on exchange area cables which appeared in the Record for April was abstracted in *Nature* for June 20. Other Record articles abstracted in recent issues of this magazine include *D-C Substitution Method of Measuring High-Frequency Attenuation* by H. B. Noyes; *Cellulose Acetate Yarn Replaces Silk for Wire Insulation* by D. R. Brobst; *An Improved Capacitance Bridge for Precision Measurements* by W. D. Voelker; *Lodgepole Pine Poles* by C. H. Amadon; *High-Precision Frequency Comparisons* by L. A. Meacham; *Brittle Temperature of Rubber* by M. L. Selker; and *Behavior of Sulfur in Rubber* by G. G. Winspear.

James W. Farrell, as noted in the last issue of the Record, has been elected president of the Edward J. Hall Chapter, Telephone Pioneers of America, and William H. Matthies a member of the Executive Committee. Committee members have since been appointed and Laboratories representatives on those committees are: *Publicity*, G. F. Fowler; *Entertainment*, E. D. Johnson, chairman, and D. D. Haggerty; and *Membership*, W. A. Bischoff, R. C. Mathes, A. E. Petrie, Miss Leah Smith and R. H. Wilson.

J. J. Lander presented a paper, *Diffuse Superstructure Lines*, at a meeting of the American Society for X-Ray and Electron Diffraction held at Gibson Island, Maryland, from July 27 to 31.

Some Observations on the Use of Powders in Spectrochemical Analysis, a paper by A. E. Ruehle and E. K. Jaycox, was presented before the Tenth Annual Summer Conference on Applied Spectroscopy of M.I.T. by Mr. Ruehle on July 20.

C. A. Webber discussed cable problems with engineers of the Simplex Wire and Cable Company at Boston and of the General Electric Company at Bridgeport.

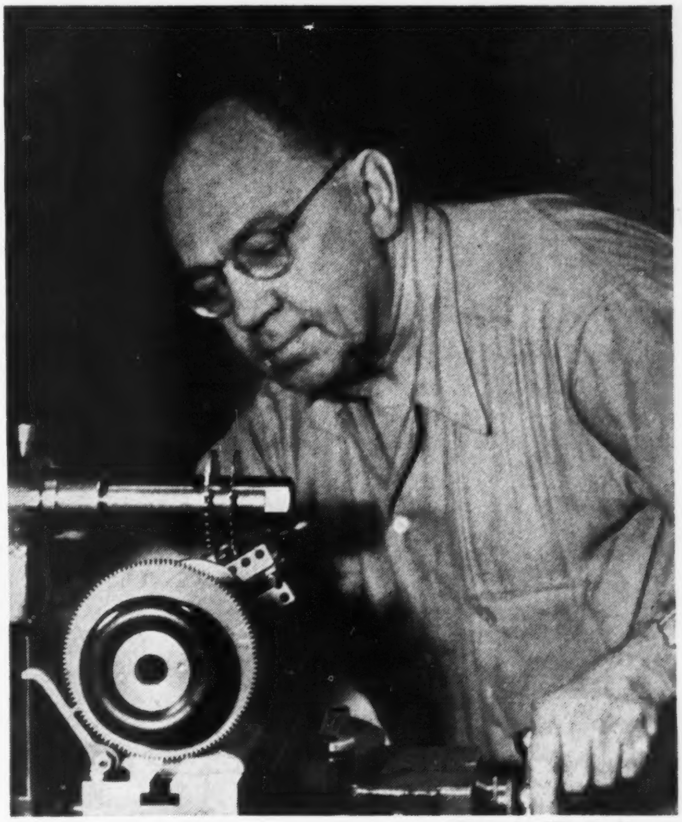


Photo by W. R. Neisser

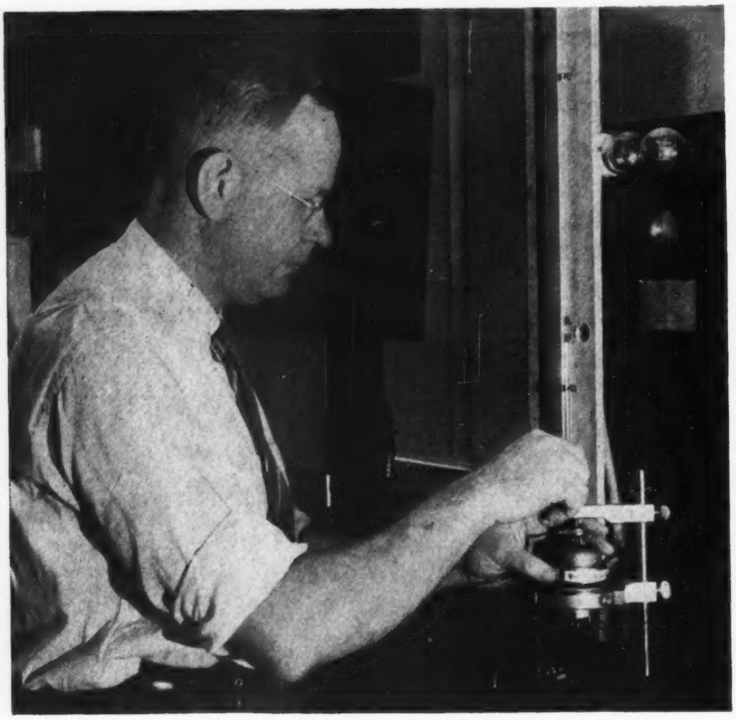
F. A. Voos, who retired from the Laboratories in 1940, using a milling machine in his well-equipped home shop

Some Members of the Laboratories

THIS MONTH the RECORD presents the following biographies of members of the Laboratories chosen by lot.

* * * * *

LOUIS A. MORRISON grew up in a laboratory—principally at Earlham College, in Indiana—for his father was Professor of Physics there. His college course was interrupted by World War I, during which he served overseas for eighteen months as an ambulance driver for the American Friends Service Committee. In 1924 he graduated from Michigan State, and the following year got his M.S. from the University of Michigan. Then entering the transmission instruments group of the Laboratories, he worked on the 555-type loudspeaker and on the 4A phonograph reproducer, both widely used by the sound-picture industry.



LOUIS A. MORRISON

Taking up basic studies on the telephone receiver, Mr. Morrison with his associate E. E. MOTT invented a simple and effective method for measuring the ratio of electrical input to motion of the diaphragm. The procedure was to move the diaphragm mechanically by a known amount and measure the electrical output by a ballistic galvanometer. With this as a tool they made extensive investigations of what happened when variations were made in air gap pole face area, diaphragm thickness. By using a thicker diaphragm and more effective structure with some of the new magnetic materials, they were able to develop a receiver of much better rating on articulation tests. Now coded the HA-1, more than nine million of these receivers have been produced by Western Electric for Bell System use.

Residents of Madison, both Mr. and Mrs. Morrison take an active part in civic affairs. Gradually he is filling their home with furniture of his own make. That activity, with reading, are his winter recreations; in summer he visits one or another of the eastern mountain ranges for life in the outdoors.

* * *

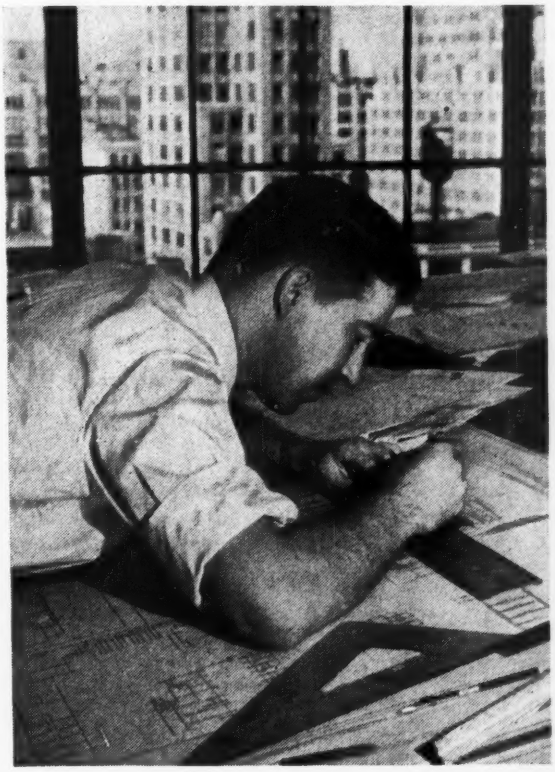
"DICK" ROECKL, as his friends in Circuit Drafting know him—Francis C. on the records—entered the Laboratories in 1936 after graduating from the electrical course at Brooklyn Technical High School. Soon he went into the drafting room, and now makes up circuit schematics from the engineers' sketches. A schematic, if you don't know already, is a drawing which tells those skilled in the art how a circuit works. So it must be easy to follow, and that is where the draftsman's skill in arrangement of leads and apparatus comes in.

Dick used to take part in various sports until he had an accident; now he enjoys

them from the stands. He supports his mother and lives at home in Brooklyn. If his father, now dead, could see Dick at home and at work, he would indeed rest in peace.

* * * * *

IF FRANK SHIEL's boyhood ambition had been realized, he would have followed the family pattern and become a member of the New York City police force. But his eyes kept him out and when his school days ended he got a job in a mercantile house. After nine years there and four years with a restaurant chain he entered the Laboratories in 1935 as a stockkeeper. Until last November he was in the 4-C storeroom at West Street; then he was put in charge of the Building 21 storeroom at Murray Hill.



FRANCIS C. ROECKL

Manhattan-bred and a bachelor, Frank has adapted himself to the suburban life of Murray Hill. With a dozen or more Laboratories men he lives at the Summit YMCA. One night a week they have the pool and gym to themselves. Other evenings he roots for the Laboratories softball team. His own game, however, is badminton. Engineers can help themselves from the open shelves of his storeroom, so his work is to answer questions, forward draw-out tickets to Stock Control and see that his two men keep the shelves neat. His particular pride is his ability to locate things he does not stock—no inconsiderable feat in these days of scarcities.

* * * * *

A GOOD-WILL EDUCATIONAL OFFER by the French Government started STEPHEN BOBIS on his way from Transylvania to the Laboratories. Excellence of his high school work got him a scholarship in France, first at the Lycée St. Louis, then at the University of Grenoble in electrical engineering. Meanwhile, Miss Helen Clark had graduated from Stanford and had gone to Grenoble to improve her French. At Grenoble they met, and in New York some four years later they were married.

FRANK J. SHIEL

Mr. Bobis joined us in 1928 after a short time with Western Electric and Northern Electric. He became a member of the Filter Development group, where his specialty is low-pass, high-pass and wideband filters employing quartz crystals. A big project in which he participated was the development

STEPHEN BOBIS

H. W. SCOVILL, II, of the Murray Hill Personnel Unit, attended a Job Instructor Trainer Course sponsored by the Training Within Industry Division of the War Manpower Commission. The course, which was held in Newark from July 27 to 31, was attended by fifteen representatives from selected industries in the Northern New Jersey area. Its purpose was to instruct a group of men to train supervisors who will in turn train workers.

H. A. AFFEL, in the July issue of the *Proceedings of the Institute of Radio Engineers*, reviews A. M. Cooper's book *How to Supervise People* (McGraw-Hill).

of filters for the type-L Carrier System for coaxial cables. His technical contributions have been in constant-resistance filters; three United States patents have been granted him in that field.

With their two daughters, aged 10 and 13, Mr. and Mrs. Bobis live on upper Riverside Drive. Summers the rest of his family spend in Connecticut; Mr. Bobis joins them for his vacation. He owns to no sports or hobbies, but enjoys sketching and photography outdoors; drama and orchestra indoors. Brought up on Hungarian, he still counts "egy, kettö, három . . ."

NEWS NOTES

A. R. KEMP discussed synthetic rubber with the duPont chemists at Wilmington on July 31.

A. E. PETRIE visited the Bureau of Ships at Washington on power problems.

L. J. STACY visited Trenton, Albany and Schenectady on a survey of step-by-step switch operation.

E. V. GRIGGS and E. B. CAVE attended hearings before the Board of Appeals at the Patent Office in Washington relative to applications for patent.

Lights? If in doubt put them out

C. H. PRESCOTT and G. T. KOHMAN were in Cambridge where insulation and other problems were discussed at M.I.T. and at the A. D. Little Company.

D. E. TRUCKSESS' paper, *Regulated Rectifiers in Telephone Offices*, presented at the A.I.E.E. summer convention in Chicago, was published in the August issue of *Electrical Engineering*.

C. D. HOCKER attended the annual meeting of the American Society for Testing Materials at Atlantic City. He was elected Chairman of Committee A-5 on Corrosion of Iron and Steel.

F. G. COLBATH inspected the new War Department PBX in Washington.

J. M. DUGUID, C. S. KNOWLTON, J. H. SOLE and C. W. VAN DUYNE attended a conference on machine design at Wright Field, Dayton. Mr. Duguid and Mr. Knowlton also visited the General Electric Company at Fort Wayne.

G. W. MESZAROS was at the Western Electric Company at Chicago on the production of power equipment.

U. S. FORD was in Wilmington, Delaware, where he made changes in the trial installation of the trunk-usage and dial-speed register.

V. T. CALLAHAN, at Lansing and Muskegon, Michigan, discussed the development of engines for power plants.

Food for Thought

By Dr. Leverett D. Bristol

Health Director, A. T. and T. Company

Among the adjustments to a simpler mode of living which now face us all, changes in food habits may be necessary. As war restrictions are imposed, substitutes offered and the food dollar stretched, thought must be given to those foods known to be the foundation of an adequate diet and the chief defense against malnutrition. A well-balanced diet of wholesome natural foods suggested below will provide all the nutritional essentials, including the important vitamins, needed by the average normal healthy person and will make the indiscriminate use of separate vitamin concentrates unnecessary:

Milk for every age is indeed the captain of foods. It matters not whether it is consumed as a beverage, in creamed foods, soups, sauces, desserts, or with cereals. Authorities suggest that at least as much should be spent for milk (including cream and cheese) as for meats, poultry, and fish. Its protein—the building and repair factor—is of the highest quality and it is unequalled as a source of calcium.

Bread and Cereals are the staff of life. They are most valuable if the whole grain varieties are used liberally. The white varieties provide little food value other than energy. Half the bread or cereal eaten each day, including toast, muffins, and sandwiches, should be of the dark, whole grain, or enriched variety.

Vegetables and Fruits, daily, the year round, are the "musts" for good nutrition. Dark green leafy vegetables and dried peas and beans are excellent sources of iron; the dark green leaves and the deep yellow vegetables provide Vitamin A. One ordinary serving of a green vegetable will supply, on an average, half the required daily units of that vitamin. Those vegetables commonly eaten raw, together with the citrus fruits, are the chief natural reservoirs of Vitamin C. One medium-sized orange, or a small, mixed green salad, will furnish about two-thirds of the daily amount required by the adult.

Meat, Fish and Eggs promote growth and repair of body tissue. We hear much today about protein foods. These come from animal and vegetable sources. Animal proteins provided by meat, eggs, fish, and dairy products resemble those in the human body more closely than those from vegetable sources, such as peas, beans, and lentils; hence, should form a part of the total day's food supply. Economy cuts of meat, while requiring a better cook, furnish just as much nourishment as a thick, juicy steak. The "spare parts," kidney, heart, liver and brains, are highly nutritious. Lean pork is one of the best sources of Vitamin B_1. Fish, in many respects, is as good as meat, nutritionally speaking. Eggs at breakfast help to get one off to a good start for the day. They also can be used as meat substitutes for

John Bachor
of Restaurant Service completed thirty years of Bell System service on the nineteenth of August

Russell B. Buchanan
of the Switching Development Department completed thirty years of service in the Bell System on August 15

William G. Schaer
of the Equipment Development Department completed thirty years of service in the Bell System on August 11

other meals and should be eaten at least three or four times a week. The yolks are rich in iron, Vitamins A and B_2, and are among our few natural sources of Vitamin D—that factor which growing children need for strong bones and teeth.

Fats in moderate amounts are necessary for the maintenance of good health, in addition to making food more palatable. Butter or the vitamin-enriched margarines are among the best sources of Vitamin A.

Like the person who "couldn't see the woods for the trees," some people can't see the foods for the vitamins. Get a variety of sufficient natural foods each day. Let your doctor advise as to whether or not you have any vitamin or other food-element deficiency which might require special treatment.

Collegiate Degrees

Members of the Laboratories on whom collegiate degrees have been conferred since the first of this year are:

K. Boyer	B.S. in E.E.	U. of Utah
H. B. Brehm	B.E.E.	Cooper Union
A. Decino	M.S.	Stevens
E. Habit	M.S.	N. Y. U.
J. H. Heiss, Jr.	B.S. and E.	Newark College
F. J. Herr	B.E.E.	Cooper Union
A. E. Joel, Jr.	M.S.	M. I. T.
W. McMahon	B.S.	Brooklyn Poly.
G. W. Meszaros	B.E.E.	C. C. N. Y.
W. C. Michal	B.E.E.	C. C. N. Y.
C. J. Norton	B.S.	N. Y. U.
J. J. Scanlon	B.E.	Brooklyn Poly.
J. T. Torian	M.S.	Columbia
L. M. Towsley	B.A.	Brooklyn College

News Notes

W. G. Straitiff and J. H. Ingmanson visited Point Breeze to discuss rubber-covered wire development problems.

V. T. Wallder, at Point Breeze, discussed switchboard cord development problems.

J. M. Duguid discussed machine problems at the Bureau of Ships and at the Naval Research Laboratories at Washington.

J. H. Sole is at Fort Wayne on machine design.

Forty average phonographs require the plastics of the cowling of a pursuit ship.

Vernon D. Gallagher
newly appointed manager of Bell Laboratories Club Store, comes to us from Sears, Roebuck & Company, Morristown

J. H. Shepherd visited several manufacturers in Illinois and Wisconsin on matters relating to fractional horsepower motors.

C. H. Achenbach visited the Northern Electric Company at Montreal on power problems.

D. D. Miller made several trips to Leeds and Northrup Company, Philadelphia, in connection with special government work. P. T. Higgins accompanied Mr. Miller on one of his trips.

R. T. Staples was at Point Breeze in connection with cord development problems.

W. V. Thompson, at the Hawthorne plant of the Western Electric Company, conferred with their engineers on wire development.

D. R. Brobst was at Washington and at Hawthorne for discussions on cable and wire designs.

J. H. Ingmanson was elected chairman of A.S.T.M. Committee D-11 on Rubber and Rubber-like Materials at the annual meeting of the Society in Atlantic City.

L. E. Dickinson, D. G. Blattner and G. H. Downes, with H. W. Bowly of the Western Electric Installation Department, were at Sharon, Pennsylvania, to inspect a trial installation of new step-by-step banks.

R. H. COLLEY and G. Q. LUMSDEN spent a few days in Minneapolis to carry on experimental treatments with creosote-petroleum-pentachlorphenol solutions for new northern pine crossarms and for western cedar poles.

R. H. COLLEY visited Savannah to observe the first commercial treatments of southern pine poles with creosote-petroleum-pentachlorphenol solutions. He also visited Augusta and Spartanburg (S. C.) in connection with southern pine pole production problems.

W. A. YAGER has been appointed to the Technical Committee on Insulating Materials of the Electrochemical Society.

A New Frequency-Modulation Broadcasting Transmitter, a paper by A. A. SKENE and N. C. OLMSTEAD presented before the 1941 Summer Convention of the Institute of Radio Engineers, was published in the July issue of the Institute's *Proceedings*. A four-and-a-half-page abstract of this paper appeared in the July issue of the RECORD.

THREE STANDARDS have recently been issued by the Institute of Radio Engineers, two on Radio Wave Propagation, *Definitions of Terms* and *Measuring Methods*, and one on Facsimile, *Definition of Terms*. RALPH BOWN is a member of the Standards Committee, C. R. BURROWS, of the Technical Committee on Radio Wave Propagation and PIERRE MERTZ of the Technical Committee on Facsimile.

More metal, more man-hours and more machine-hours go into one typewriter than into one Garand rifle.

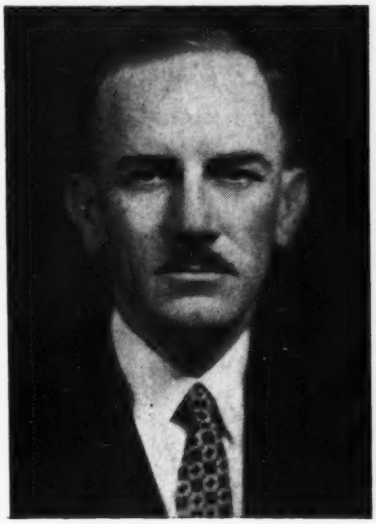
W. J. CLARKE and J. B. DECOSTE visited Hawthorne on enamel wire problems.

C. S. FULLER presented a paper entitled *Properties and Structure of Linear Polyamides* at a conference on Textile Fibers held by the American Association for Advancement of Science at Gibson Island, Maryland.

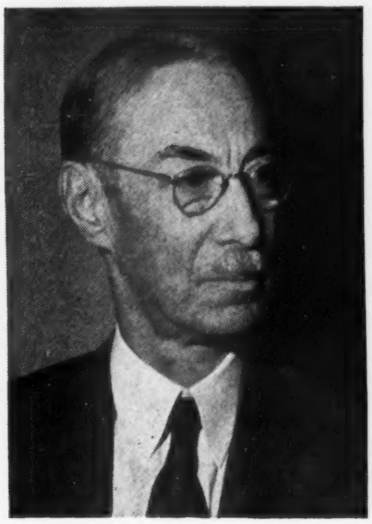
F. A. KORN and A. S. KING visited New Haven and Carteret in connection with installations of new step-by-step universal-switch shelves. Mr. King also went to Hawthorne to discuss with the engineers of the Western Electric Company the manufacture of these shelves.

G. T. FORD and D. ROSS visited Washington in connection with plastic nameplate substitutes for metal nameplates.

W. O. BAKER attended the Conference on High Molecular Substances at Gibson Island, Maryland.



BRYCE O. TEMPLETON
of the Station Apparatus Development Department completed thirty years of Bell System service on August 12



RICHARD A. HAISLIP
of the Outside Plant Development Department completed thirty-five years of service in the Bell System on August 12

CARL E. BOMAN
of the Equipment Development Department completed thirty-five years of service in the Bell System on August 4

Mrs. Margaret A. Boutrelle

Members of the Laboratories who completed twenty years of service in the Bell System during August were:

Apparatus Development Department

V. F. Bohman
P. S. Darnell
H. J. Elwood

Systems Development Department

W. W. Brown
E. A. Looney
J. R. P. Goller
T. A. Marshall
J. L. Larew
F. J. Singer
Arthur Zitzman

Research
J. C. Steinberg

General Accounting
W. H. Clarkson

Patent
Dorothy Allyn

Commercial Relations
Marjorie Broderick

General Service
William Schwarz

Plant
John Kielin

Mrs. Margaret A. Boutrelle, a draftswoman in Equipment Development, retired from active service at her own request at the end of last month. She entered the New York Telephone Company's advertising department in 1912 after studying at Adelphia College and the New York School of Fine and Applied Art. During World War I she was a French language telephone operator for the A.E.F. in France both at St. Nazaire and in Paris. On demobilization, she entered the Drafting Department of the Laboratories. Here, her interest in art and her feeling for perspective have brought her many of the difficult jobs, such as photograph retouching and the pen-and-ink renditions of apparatus which are used in Bell System practices.

During her career, Mrs. Boutrelle took a number of the Laboratories' out-of-hour courses. Not allowing her art to be forgotten, she took courses in mural decoration and in photography, and was a member of the National Association of Women Artists and of the Art Group of the American Women's Association.

Twenty-Five-Year Service Anniversaries

Before Fred W. Hecht joined the Engineering Department of the Western Electric Company in 1917 he had worked for a period of fifteen years with other concerns, six years of which were with Crocker, Wheeler and Company manufacturing electric motors. Here at West Street he entered the Development Shop as an instrument maker. During most of the war period he was on the night shift making tools and apparatus parts, principally for Signal Corps use. He spent the next twelve years on the usual run of work going through the Development Shop though much of it was concerned with airplane detecting apparatus.

When a large portion of the Commercial Products Development Department moved to the Graybar-Varick building in 1930, Mr. Hecht also went and for the next few years did shop work on radio equipment for the Navy and Signal Corps. For the past six years he has continued this type of work at the Whippany laboratory.

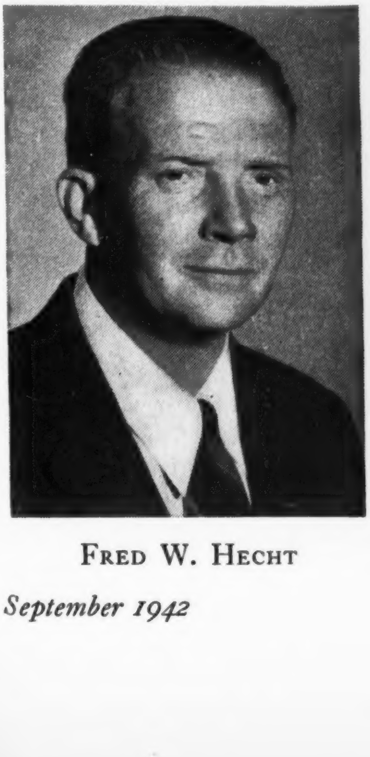
The Hechts live in West Caldwell, New Jersey. Their daughter worked a year here at the Laboratories and then married Albert Voinier of the Development Shop at the Graybar-Varick building. Their son will be a senior in high school this fall. At Whippany Mr. Hecht takes an active part in horseshoe pitching, soft ball and volley ball. Before that, when he was in New York, he was a catcher in the Laboratories Club Baseball League, first on the Shop team and then on the Graybar-Varick team. At home he is interested in growing flowers and is quite proud of his Victory garden. For thirty-five years he has also been interested in fraternal activities.

* * * * *

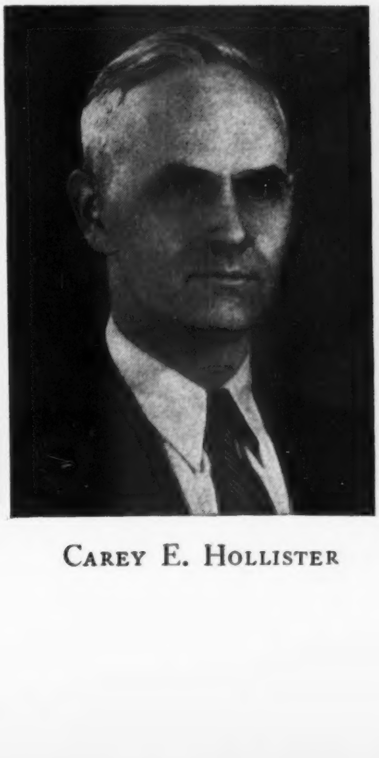
R. H. Clapp joined the Research Department of the Northern Electric Company after he had received his degree of B.S. in Electrical Engineering from Union College in 1917. Two months later he joined the Army and gravitated into the 303rd Field Signal Battalion with which he served for two years, coming out as a First Lieutenant. He was in the advance party of the 78th Division, attended the Army Signal School in Langres and was then in charge of signaling for the 311th Infantry in combat until the end of the war. On his return Mr. Clapp joined the Department of Development and Research of the A T & T. His first work here was on the development and field application of carrier telegraph systems. He was in Harrisburg in 1919 and 1920 in the first field trial of such systems between Harrisburg and Chicago; the A T & T representative on the carrier telegraph transmission phases of the first Key West-Havana submarine cables; and in charge of the A T & T transmission field testing of the first transcontinental carrier telegraph system from Chicago to Oakland, Calif.

For several years Mr. Clapp was concerned with the elimination of interference, caused by static and lightning, in carrier telegraph systems. In 1930 he was in charge of the transmission features of the application of carrier telephone from the non-loaded No. 4 Key West-Havana cable. Since 1932, first with the D & R and since the 1934 consolidation with the Transmission Engineering Department, he has been concerned with studies involving the economic advantages and fields of applications of voice and carrier toll systems, both telegraph and telephone, and particularly the J, K and L broadband systems.

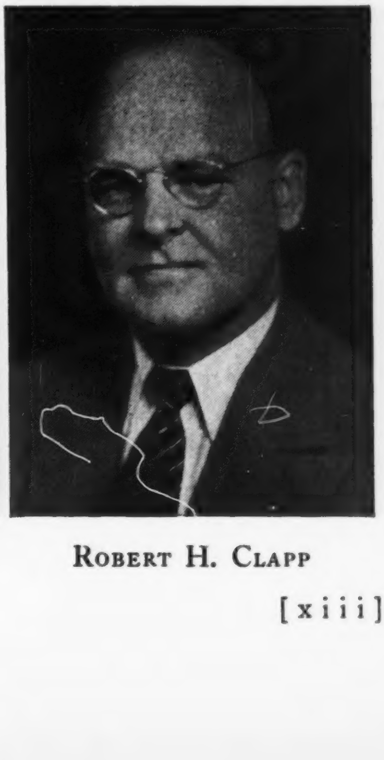
The Clapps live in Ramsey, New Jersey, with their five children, four sons and one daughter. The two oldest are in high school. Mr. Clapp's main hobby is his woodworking shop where he tries to keep up with the wear and tear in furniture caused by a normally active family. His favorite outdoor activity is tennis. He is an active member of the Gideons, particularly in connection with the distribution of Bible portions to men in our armed forces. Mr. Clapp is a Telephone Pioneer.



Fred W. Hecht



Carey E. Hollister



Robert H. Clapp

Graduating from Cumberland University in 1915 with a B.S. degree, Carey E. Hollister then studied for two years at the University of Tennessee, specializing in mechanical and electrical engineering. He then joined the Engineering Department of the Western Electric Company on relay design requirements. Early in 1918 he entered the Army and after training at Camp Pike in Arkansas for a time came back to West Street on an indefinite furlough to work on magnetic apparatus for the Signal Corps. Following the Armistice he returned to his original group and for the next ten years engaged in the calculation and design of coils for relays and other magnetic apparatus and was associated with the development of the 215-type polarized relay.

From 1928 to 1937 Mr. Hollister was in the machine switching and step-by-step laboratory of the Apparatus Development Department where his work was in connection with cork-roll drives, multiple brushes, step-by-step relays and switches and rotary contact switches. He then transferred to the Apparatus Specifications Department where, for a time, he was concerned with relays and associated apparatus. More recently, in the specifications group at the Murray Hill laboratory, he has handled outside plant apparatus.

Mr. Hollister lives in Towaco, New Jersey, and his eighteen-year-old daughter attends St. Mary's Episcopal School in Valhalla, New York. An expert rifleman, he belongs to the Laboratories Rifle Club and was a member of the former North Jersey Rifle and Pistol Club. He also has bowled for many years. Mr. Hollister has belonged to the Towaco Volunteer Fire Department for the past fifteen years and in this connection designed and installed a new alarm system in 1931 on which he has recently made improvements for air raid service. He is a mountain climber of some ability, having the unique record of scaling Mt. Washington twice in forty-eight hours.

* * * * *

Charles L. VanInwagen, Jr., who joined the Engineering Department of the Laboratories in 1917, spent one year at the University of Cincinnati and three years at the Rochester Athenaeum and Mechanics Institute from which he graduated in 1915, specializing in electrical engineering. Following two years in the Engineering Department of the Selden Motor Vehicle Company he came to West Street where he was first concerned with the design of central-office apparatus and of radio and telephone apparatus used in World War I. After the Armistice, he continued the development and mechanical design of central-office and outside plant equipment, principally toll ticket and distributing systems, electric-soldering coppers, cable splicing machines and small tools for office maintenance, and public address equipment.

In 1929 Mr. VanInwagen joined the Outside Plant Development Department where he continued with development and design of cable placing machines and cable splicing tools. Four years later he transferred to the Commercial Products Development Department on the mechanical design of ultra-high-frequency radio transmitting equipment for commercial and government use and then spent one year on audiometers and audiphones. From 1939 to the middle of 1941, in the electromagnetic apparatus switching studies group, he engaged in the development and mechanical design of high-speed panel switching apparatus and studies of methods for producing step-by-step contacts with precious metal inserts, part of a noise reduction program. He then returned to Commercial Products Development Department where he has since been concerned with the mechanical design of radio equipment for the Army and Navy.

Mr. and Mrs. VanInwagen have two children and a grandson. Their daughter, now married, was educated at Cornell and at Katheryn Gibbs Secretarial School in Boston. Their son received his B.S. degree

from Pennsylvania State College this June and is now a Second Lieutenant in the Engineers Corps at Fort duPont, Delaware. The VanInwagens live in Rutherford where they both take an active part in church, civic and social affairs. He is interested in music, photography and his basement workshop.

* * * * *

A. L. Petizon joined the Engineering Department of the Western Electric Company in 1917 as a draftsman in the Printing Telegraph Department and for five years was engaged in the design of such apparatus as the 6A distributor and the 10A printer. During World War I some of his time was spent on a special coding device developed for the U. S. Signal Corps.

In 1922, when most of the printing telegraph development was taken over by the Teletype Corporation of Chicago, he transferred to the Apparatus Development Department and after a year at drafting became a supervisor of a group engaged in preparing drawings on radio transmitting and receiving apparatus. In 1924 he became a Member of the Technical Staff and a year later transferred to the apparatus specifications group. He has since been engaged in editing and checking specifications on various apparatus developed by the Laboratories, especially those for dial systems. More recently he has spent most of his time on specifications for apparatus in connection with war projects.

He enjoys outdoor life and has spent many of his vacations at a camp in the Adirondacks. He likes gardening and handicraft work in his own well-equipped work shop. He is a member of the Telephone Pioneers of America.

* * * * *

C. E. Cerveny joined the Apparatus Development Department in 1917 and until 1925 was engaged primarily as a detail, design and checker draftsman. During these years he attended Cooper Union from which he received the B.S. degree in Mechanical Engineering in 1926 and the Professional Mechanical Engineering Degree in 1938.

Mr. Cerveny transferred to the Apparatus Development Specification Engineering Department in 1925 and for the next five years was responsible for the preparation of specifications covering the manufacturing information for miscellaneous telephone and commercial products apparatus. From 1929 to 1934 he was a supervisor of a group of specification engineers in the same department. In 1934 he became a member of the Commercial Products Development Department and for the next three years was engaged in the mechanical design of marine and aircraft radio communication equipment. Since 1937 he has been in charge of a group of specification engineers who prepared the specifications covering Commercial Products Development Department apparatus which, for the past year, has consisted mainly of radio communication equipment for our

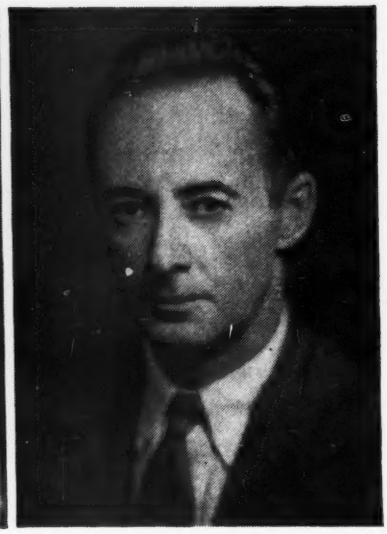
C. L. VanInwagen, Jr.

A. L. Petizon

Charles E. Cerveny

Hugh D. Bender

George H. Duhnkrack



David E. Branson

armed forces. In 1940, Mr. Cerveny originated and developed Drawing Index Form CP-10 now used in Commercial Products Development Department specifications. This form reduces, to a considerable extent, the work of the specification engineers as well as facilitating the use of the specifications by the Western Electric Company and all concerned, since it provides, at a glance, a comprehensive complete record of the latest authorized manufacturing information. This drawing index form has since been used successfully by other departments in connection with the authorization of manufacturing drawings.

Mr. and Mrs. Cerveny, who live in Allwood, New Jersey, have a daughter who will be a junior in high school next fall. He has played bridge for a number of years as a member of the Laboratories Bridge Team in the Metropolitan Commercial Bridge League. He is also active in a variety of outdoor sports. He is a Telephone Pioneer.

* * * * *

For twenty-two years of his service in the Bell System, H. D. Bender has been associated with the development and standardization of the hand tools and associated equipment used by the outside plant construction and maintenance forces of the Bell System. During these years he has been instrumental in bringing about a steady, marked improvement and simplification which range in size and variety from the small tools used by station installers to the massive types required in heavy construction work.

"Chief" Bender received his B.E.E. degree from Ohio State University in 1917 and upon completion of the A T & T student course undertook the preparation of Bell System Practices in the Engineering Department of that company. Early in 1918 he became a gunnery instructor in the Air Corps ground school at Ohio State. In July of that year he transferred to the Field Artillery Officers' Training School, first at Camp Taylor in Kentucky and then at Fort Knox, where he received his Second Lieutenant's commission in the Field Artillery Reserve Corps. Following the Armistice he returned to the A T & T Engineering Department and joined the group handling the standardization of outside plant materials. This group carried over to the D & R when this was formed in the middle of 1919. Late in 1920 he transferred to the group handling outside plant tool development and standardization, this group becoming part of the Outside Plant Development Department of the Laboratories in the 1934 consolidation.

The Benders have recently moved from East Williston, Long Island, to Madison, New Jersey. They have one daughter who completed her first year at Middlebury College this past June. Mr. Bender is quite fond of golf and took an active part in the Wheatley Hills Golf Club as committee chairman. He had to give himself a 10 handicap. He is a Telephone Pioneer.

Practically all of George H. Duhnkrack's twenty-five years of service have been devoted to toll circuit development and analysis work. Shortly after he joined the Laboratories he entered the toll circuit laboratory. He completed two years of the technical assistants' course and then studied for three and a half years at Brooklyn Poly. During World War I he was engaged in testing radio telephone equipment for submarine chasers and in this connection spent six months at New London on the installation and testing of this equipment. Returning to the toll circuit laboratory, Mr. Duhnkrack worked on the start-stop toll distributor system and was associated with its installation and testing between New York and Philadelphia. He was also associated with the testing and installation of a selective signaling system between Albany, Troy and Glen Falls.

Later Mr. Duhnkrack transferred to the standard toll circuit development group and then, when the toll circuit analysis group was organized, he joined this group where later he had the responsibility of checking the circuit and analysis work of the group. Among the projects with which he was concerned were the circuit analysis and special development of the No. 3 toll switchboards in the New York and Chicago toll offices, conversion to the recording-completing method of toll-traffic, toll transmission pad control, composite signaling, and toll-circuit phases of program transmission and switching and voice frequency amplifiers. From 1936 to 1938 he did similar work in the dial-circuit analyzation group and spent some time on the circuit development for the 35-type community dial office. He then returned to his former group and for the past year has been concerned with the checking of the circuit and analysis work of the group in connection with its decentralization of toll equipment in large central offices and with special circuit design and analysis for Army and Navy projects.

Mr. and Mrs. Duhnkrack, who live in Maplewood, have two boys in Junior High. They have a bungalow at Green Pond where most of their summers are spent. For many years Mr. Duhnkrack has been active in the affairs of the Laboratories Club, being a member of the Archery and Stamp Clubs and a former member of the Bowling League.

* * * * *

During D. E. Branson's service in the Bell System he has been responsible for many new features of electrical circuits and equipment used in giving telegraph and telephotograph service. Following his graduation from Purdue in 1917 with the degree of B.S. in Electrical Engineering he immediately joined the American Telephone and Telegraph Company where he tested and prepared maintenance information on manual and printing telegraph equipment. From August, 1918, to September, 1919, he was with the U. S. Naval Reserve in Washington, first as a chief petty officer and then as an ensign. During this time he tested aircraft radio telegraph and telephone sets in flight and later had charge of their installation in Naval aircraft. Prior to the Navy's first transatlantic flight, he supervised the wiring of the N.C. flying boats under Admiral Richard E. Byrd.

Mr. Branson then returned to the D & R and since then has been intimately associated with the development and initial field applications of new arrangements using direct currents for providing telegraph service over small gauge cable conductors; with engineering and constructional phases of the first photographic equipment used for tests and demonstrations; with investigations of the early types of telegraph repeaters which resulted in the preparation of service requirements on new repeaters; with the development of receiving relays used in d-c telegraphy as well as in carrier and other telegraph systems employed by the A T & T and Associated Companies; and with surveys of relay performance under service operating conditions which were made to improve contact materials, mechanical construction and magnetic assembly of relays.

Gordon K. Smith

William J. Cuddy

His recent work has been on the TWX switching system for the Republic Steel Company and on war projects.

Mr. and Mrs. Branson live in River Edge, New Jersey. He served on the Board of Education for six years and was its president in 1939. Photography is one of his hobbies and in this connection he assembled the telephoto camera now used by the Laboratories to photograph sunspots. He had originally assembled this equipment to photograph the total eclipse of the sun in 1924 and the Laboratories took over the equipment shortly thereafter. Mr. Branson has been a member of the Bogota Rifle Club for the past twelve years, is a member of the Englewood Yacht Club, owning a 34-foot cabin cruiser, and is a Telephone Pioneer.

Retirements

Gordon K. Smith of the Systems Development Department retired at his own request on the sixteenth of August upon completion of forty years of service. Mr. Smith came to the Western Electric Company directly after his graduation from Pratt Institute in 1902. First at West Street and later at Hawthorne, he was concerned with equipment drafting work. In 1910 he transferred to equipment engineering and two years later returned to New York where he became associated with the development of panel central-office equipment. He took a prominent part in the first tests at West Street and, for the later trial in Newark, wrote most of the equipment specifications.

During World War I Mr. Smith worked on specifications for the private branch exchanges used by the Post Office and the Department of the Interior, and for step-by-step PBX's for railroads. Since then he has been concerned with the development of step-by-step equipment including that of tandem offices, and more recently with the development of crossbar equipment.

* * *

William J. Cuddy retired under the Retirement Age Rule on July 31, after completing over forty-one years of service with the Western Electric Company and the Laboratories. After working in various capacities in the Accounting Department of the Western Electric Company, Mr. Cuddy in 1907 transferred to the Factory Engineering Department, forerunner of the present Plant Department, where he was in charge of the clerical work. In 1919 he returned to the Accounting Department in charge of special plant studies. Two years later he was transferred to statistical work on special reports of company activities.

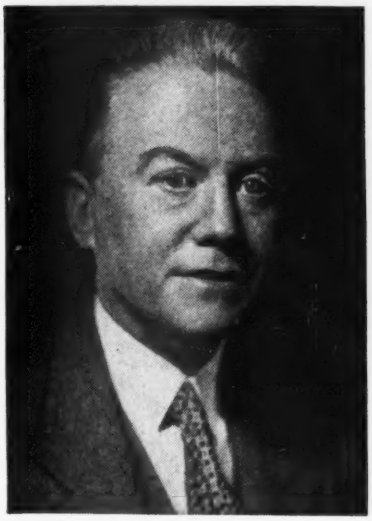
In 1923, Mr. Cuddy took charge of plant accounting on buildings, permanent fixtures, machinery and furniture. From 1929 to 1937 he was in the voucher accounting group and since that time he has been assigned to the Expense Accounting Department, where he has handled the accounting on toll calls.

* * * * *

John F. Hearn of the Apparatus Development Department retired at his own request on the last day of July after completing thirty-four years of service. He studied mechanical and electrical engineering for four years at the College of the City of New York and then spent a year with the Electrical Testing Laboratories before joining the Western Electric Company in 1906. When the Switchboard Drafting Division was transferred to Hawthorne in 1908 he left the company and spent two years in designing adding machines of an automatic

electric type. Mr. Hearn then returned to West Street and until 1928 was engaged in the development of central-office apparatus for rotary, semi-mechanical and full-automatic dial systems.

In 1928 Mr. Hearn transferred to what is now the Switching Apparatus Development Department where he has since been concerned with the design and development of relays and short-circuiting relay protectors. More recently he has been closely associated with the development of U and Y-type relays and of time-delay relays. Resulting from his activities in these fields are many patents covering special types of switches and selectors and relays of multi-contact, stepping and polarized types.



John F. Hearn

Obituaries

Gladston Matejka, 1896-1942

Gladston Matejka, who was pensioned in 1936, died on July 26. Mr. Matejka, after studying at the Armour Institute of Technology for two years, joined the Western Electric Company at Hawthorne in 1917 as a clerk. Shortly thereafter he joined the Army and for the next year and a half was chief clerk for a railway transportation officer. From 1919 to 1929 he was an investigator, draftsman and then an engineer in charge of the design investigation section of the Manufacturing Planning Branch at Hawthorne, particularly concerned with sound recording and reproducing apparatus.

Mr. Matejka transferred to the Commercial Products Development Department of the Laboratories in 1929 where he was first engaged in the design of sound-picture reproducing equipment for theaters. Three years later he joined the radio group and from then until his retirement in 1936 was concerned with the design and the preparation of manufacturing information for the production of aircraft and mobile radio telephone apparatus.

G. Matejka

C. J. Glinane, 1896-1942

Charles James Glinane, Superintendent of Plant Relations, died suddenly during the night of August 9 at his summer home at Lindy Lake, near Butler, N. J.

Mr. Glinane was educated in New York City high schools and at Pace Institute of Accounting. He joined A T & T in December, 1910, as a messenger, advancing through various grades to become chief clerk of the Department of Development and Research. With that department, he transferred to the Laboratories in 1934, soon being appointed Merchandise Manager in charge of the storage and distribution of materials. In 1937 he became Superintendent of Plant Relations.

Mr. Glinane lived in Hollis, L. I. He is survived by his wife, Cecile, one son, Robert, who is about to enter the Air Corps, U. S. Army, and three daughters.

C. J. Glinane

* * *

There has been recently organized a Radio Transmitter Manufacturers' Industry Advisory Committee to the Radio Section of the WPB Communications Branch. This committee will study civilian and military transmitter equipment and will

determine the transmitter requirements of broadcasting, police and other emergency services, aircraft, ship-to-shore, point-to-point and international radio needs, including frequency modulation and television. Recommendations will be made for the conservation and proper maintenance of these services and the standardization of police and other radio equipment during the war period. H. N. Willetts, Radio Department Manager of the Western Electric Company, has been elected to serve on this committee.

* * * * *

W. C. Ball and J. H. Harding went to Ridley Park, Pennsylvania, to install an automatic oscillograph in connection with inductive coördination studies.

L. S. Inskip made a trip to Lynchburg, Virginia, for his studies of lightning.

E. H. Gilson, in company with A. M. Stolte and G. J. Christ of the New York Telephone Company, visited Farmingdale, Long Island, in connection with an inductive coördination problem.

A. H. Schirmer has been appointed a member of the Emergency Committee of the Electrical Committee, National Fire Protection Association. This Committee is empowered to make changes in the rules of the National Electrical Code which seem desirable as a result of the war emergency.

A. J. Aikens and J. L. Lindner were in Las Vegas, Nevada, and Los Angeles, California, making noise induction tests.

R. M. Hawekotte and R. S. Tucker, accompanied by T. A. Taylor of the A T & T, participated in joint inductive coördination tests in northern New York State.

Testing textiles for resistance to abrasion

Abrasion Test for Textiles

By A. C. WALKER
Chemical Laboratories

TELEPHONE cords are subject to a great deal of abrasion, kinking and bending in service, and this treatment often frays their braided covering. To minimize this wear, studies are made in the Laboratories on the resistance to abrasion of threads of different materials, and of treatments to improve the life of cord braids. One test is carried out by an abrasion apparatus which wears threads or braids until they break; and the time required is taken as a measure of wearing qualities.

Threads tied in endless loops are suspended from hooks fastened to a stationary crossbar. Weights are hung from the loops and the threads are then arranged about staggered pins mounted on a movable plate. As this plate oscillates up and down under the action of a motor-driven cam it rubs the threads against each other. The cabinet, Figure 1, which encloses the apparatus is air-conditioned for humidity and temperature. Seventeen samples can be tested at a time.

Experiments were carried out on different rubbing surfaces and on the position of the threads around the pins before this design was adopted. Wear may be caused by rubbing the threads on roughened surfaces. Pins of sand-blasted glass, quartz and sapphire were tried, but even these extremely hard materials gradually become polished with use. The roughened surfaces fill with the products of abrasion and the results were rather inconsistent.

Fig. 1—Resistance to abrasion of the textile used in the braided covering of telephone cords is tested by arranging sample threads in pairs over pins and rubbing each pair against itself until it breaks

The threads are looped around the middle pin so that they twist together in a sharply bent loop as illustrated in Figure 2. Oscillating the bar draws the threads over one another and wears them at the sharp bend. It is important

to have two threads in parallel because it minimizes the tendency of the single strands to twist and untwist during the rubbing action. The threads are prevented from twisting about one another by resting the

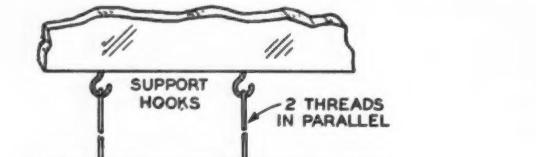


Fig. 2—Threads are looped around the middle one of three pins to form a sharply bent loop. As the pins move up and down the threads are abraided at the bend

square weight lightly against a backing plate. When the direction of twist of the loop around the middle pin is in the direction indicated by the arrow in Figure 2, the thread wears at a different rate than when the loop is formed in the other direction.

When a thread breaks, the weight hung from it falls on a balanced rod and actuates a mercury switch to stop the motor which drives the oscillating plate. At the same time a lamp lights on top of the cabinet. A counter records the number of strokes. The apparatus can be restored to its running position by a manually controlled arm which acts on the balanced rod.

Air circulation is maintained within the cabinet by an impeller fan which is driven by a motor mounted on top of the cabinet. A fin-type copper coil through which water flows provides cooling. The interior of the cabinet is lined with tinned copper and sealed to prevent loss of water vapor from the humidified atmosphere. Air temperatures are maintained to plus or minus 0.1 degree C.

Humidity within the apparatus is controlled by the simple method shown in the functional sketch of Figure 3. In a tightly sealed metal box is mounted a 25-watt electric lamp. Hanging from a hook beside the lamp there is a long cloth wick, the lower end of which dips into water in the bottom of the box. The level of this water is maintained by a syphon arrangement connected with an external water supply located on top of the outer container. A trace of wetting agent in the water assists in maintaining effective wick action over long periods. The apparatus is enclosed in a wooden container to insulate it from atmospheric temperature changes.

Dry air is supplied to the inlet tube at one side of the apparatus. By adjusting the distance of this tube from the flared outlet mounted through the opposite wall of the box, the operator controls the amount of moist air picked up from the highly humid atmosphere within the box. The inlet tube has a micrometer adjustment attached to the outside of the wooden container. With 3/8-inch diameter flow tubes and a 1/8-inch orifice on the inner end of the inlet tube, between two and three cubic feet of air can

be brought to 65 per cent relative humidity per minute by the use of a 25-watt lamp.

The humidity within the test cabinet is electrically measured by a hygrometer of a type recently developed by the National Bureau of Standards for use with radio sounding balloons in measuring the humidity of the upper atmosphere. This hygrometer is mounted on the inside wall of the cabinet just in back of the upper hinge that is shown in Figure 1. A bifilar coil of fine palladium wire wound on a small insulated aluminum tube. This coil is coated with a varnish containing lithium chloride to make it slightly conducting. The electrical surface leakage between the two parallel windings of palladium wire varies with the humidity and is measured after amplification by a vacuum tube. Different concentrations of lithium chloride in the surface varnish provide units having different humidity ranges. For example, a varnish containing 0.35 per cent lithium chloride is useful in the range from 40 to 70 per cent relative humidity.

Where the surrounding humidity does not fluctuate much and the temperature is maintained relatively constant, this method is reliable and responds very rapidly to small changes. The relative humidity can be maintained within 0.5 per cent for several hours.

One of the principal limitations to the reproducibility of results attainable in testing textiles is the lack of uniformity in the materials. In measuring the abrasion resistances of spun mercerized cotton used for telephone cord braids the method just described gave results which checked within plus or minus 15 per cent of the average for groups of seventeen samples. This is considerably better than might be expected on the basis of the variability in the spun yarn, as shown by analyses of the results of several hundred tests. Because the time required to test threads is short compared to testing finished cords, this method lends itself to rapid preliminary studies for improving wearing qualities.

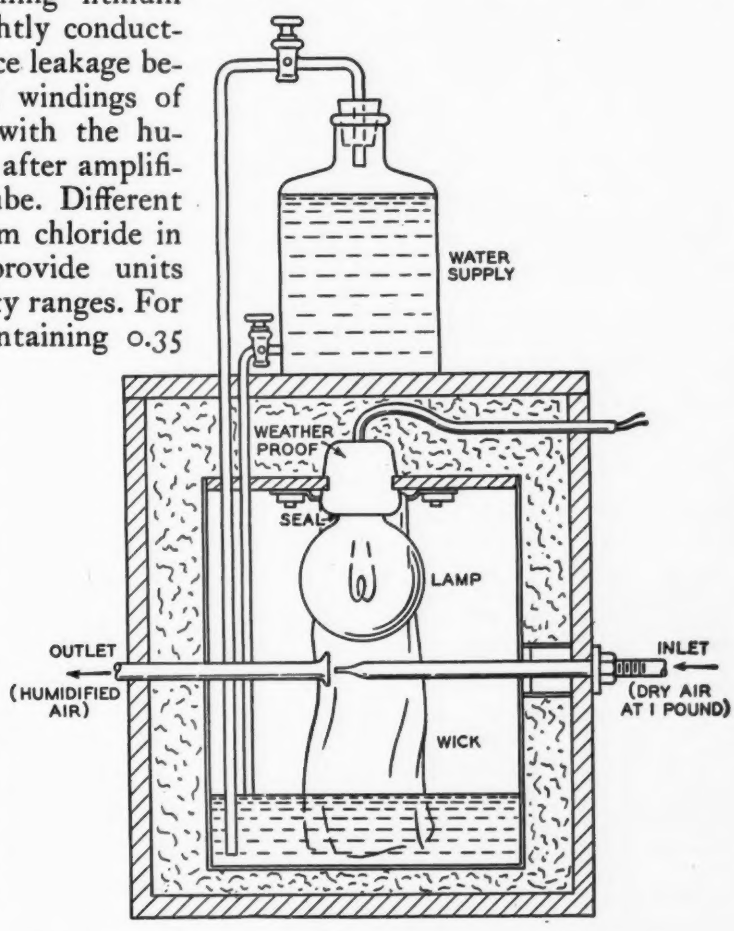


Fig. 3—Humidity in the test chamber is controlled by forcing dry air through a metal box containing moist air. Water in the bottom of the box is drawn up by a wick and evaporated by the heat of an electric lamp

Recording Plastometer for Organic Plastics

By F. J. BIONDI
Chemical Laboratories

UNDER the influence of heat and pressure organic plastics flow, and on this property the ability to mold them depends. To attain a reproducible product, time, temperature and pressure have to be controlled in the molding process. It is also necessary to know and control the effects of chemical composition and of physical factors such as moisture content.

Many devices have been used to measure the flow properties of plastics. One of these, the parallel plate plastometer, has recently been improved by the Laboratories to plot automatically the relation between the variables measured. A specimen of the material is deformed by a known force at a specified temperature and the decrease in its height with time is magnified and recorded. The plastometer developed has two horizontal plates P, Figure 1, which press between them a small cylindrical pellet of the plastic. An electrically heated and thermostatically controlled steel block C surrounds the specimen. The frame which supports this block also mounts bearings for a shaft connected to the upper plate. Weight W deforms

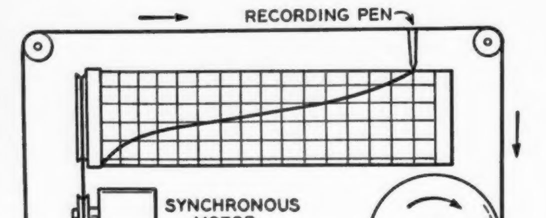


Fig. 1—Schematic of the recording plastometer showing the test pellet between two parallel plates p

the specimen. It is supported by the upper end of the shaft which is also connected by a universal link to the multiplying and recording apparatus.

A series of levers and pulleys multiplies the movement between the plates approximately thirty times. This multiplying mechanism and that which drives the paper on which the record is made are housed in the cabinet at the top of the machine. Below the plastometer are the temperature regulating equipment, voltage control and auxiliary switches. The electronic regulator controls the temperature of the steel block within narrow limits from room temperature up to 300 degrees C.

Flow curves obtained by deforming

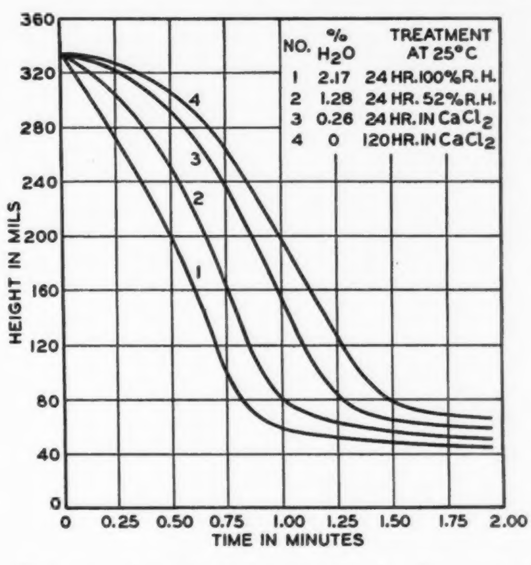


Fig. 2—A typical thermoplastic: Increased moisture makes pellets flow more rapidly

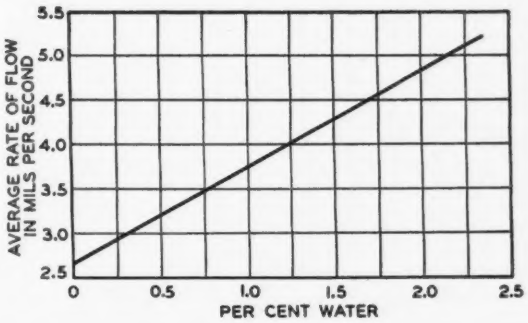


Fig. 3—Curve showing the average rate of flow of pellets of different moisture content, computed from the data of Figure 2

pellets molded from one of the thermoplastic materials currently used in telephone equipment are illustrated in Figure 2. They show that flow occurs more rapidly as the moisture content of the pellets increases. Figure 3 gives the relation between the average rate of flow and the moisture present. These curves show that the average rate of flow can be nearly doubled by changing the moisture content of the pellet two per cent. Moisture affects the flow of other plastics but not always to this extent. It is one of the variables, however, which must be measured and controlled if powder of constant flow characteristics is to be supplied to molding machines.

The recording plastometer also has been used by the Laboratories to measure the individual and combined effects of the other variables which affect the flow of plastics.

Quality Control in Ordnance Inspection

By G. D. EDWARDS
Director of Quality Assurance

[*For some months Mr. Edwards, as a consultant to the War Department, has been working on the application of quality-control procedures to the inspection of Ordnance material. At a meeting of A.S.M.E. at Cleveland in June he outlined his viewpoint on quality control. Excerpts from his address follow; the complete text appears in the September issue of* Mechanical Engineering. *The illustrations are by courtesy of* Firepower, *official magazine of the Ordnance Department, U. S. Army.*—EDITOR.]

WE HAVE a few items in the telephone industry, such as linemen's climbers, body belts, and safety straps, which are purchased by the thousands, where failure may be a real hazard to life or limb. For the Army, however, there are any number of types of matériel produced by the hundreds of thousands or even by the millions in which certain kinds of defects mean almost sure death not merely to one but to a whole group of brave men who are perfectly willing to risk their lives in fair combat. The blood of these men will be on our hands if we leave any stone unturned to prevent their being done in as a result of defective Ordnance.

I'm sure I don't need to tell you that if you are manning the lone after-gun in a bomber, with an enemy fighter on your tail, that fighter is likely to get the bomber and its whole crew including you, if a defective shell jams your gun before you succeed in putting him out of business. If you are inside a tank which is struck by a heavy shot, it won't do you much good to try to dodge the pieces of steel which spall off the inside surface of an excessively brittle armor plate and carom around inside the tank until they have killed or wounded every man they strike. If you are an officer or one of the crew manning a heavy gun and a shell explodes just before or immediately after leaving your gun because of a base cavity in the steel shell or in the explosive with which it is loaded, it is quite probable that you won't live to tell the tale. The gun itself may also be rendered useless at the same time to other men in the vicinity who are fighting for their lives.

These are representative of situations which we meet constantly in Ordnance inspection work and they call for a degree of perfection in mass production which has been uncommon in much industrial work in the past.

Determination of the presence of many of the defects which will cause such dire results often requires test and inspection procedures which are themselves destructive. In these circumstances we are forced to take some chances if we are to give the field forces any ammunition, armor plate, or other matériel to fight with at all.

But even where the necessary inspections are not destructive, you all

know our common enemy called "inspection fatigue."

If you have before you a hand truck containing say 15,000 cartridges, and you are given the job of inspecting and gaging them visually 100 per cent, I don't have to tell you that by the time you have looked at 9000 of them, they will all look alike to you, and you won't know whether the discoloration which evidences necessary shoulder anneal, for example, is there on the 9001st cartridge or not. This is no insult to your intelligence; it is just a plain illustration of experience.

So 100 per cent manual inspections are not the answer where large quantities of material are involved, even if we could put up with the resulting production delays. Mechanical gaging and photoelectric cell gaging are being introduced wherever possible to eliminate inspection fatigue; but even the best of these substitutes have their margins of error.

In other words, we have to recognize that the element of risk just can't be eliminated from quality considerations in mass production, and the real problem is how to reduce the chances we must take to a minimum without unduly impeding output. Quality-control techniques are *built* around limiting such risks to a predetermined degree, and they are thus admirably adapted to the problem in hand.

Of course the great value of quality control lies in its ability to focus a spotlight on the existence of unfavorable conditions before evidence that difficulties are developing would otherwise become available. It will do this, however, only if it is properly used, that is, if the right factors are selected for control watching, and if the mechanics of the control plan are so arranged and simplified that the necessary computations and plotting of inspection results will be carried out, and conclusions drawn from them, accurately and promptly.

If quality control is properly used in this way, an early start can be made on tracing the causes of difficulties, production of quantities of defective material can be avoided, testing and testing-equipment time and material can be conserved, actual stoppages of production can be prevented in some cases, and inspection can be converted from a hindrance to a boost for output.

So the first essential in Ordnance inspection work is that our own quality-control procedures be simple; and the second is that when such a procedure is introduced, it be oper-

Educated fingers and trained eyes pass the perfect cartridges into trays and reject those with scratches and other surface imperfections. Every cartridge is given this hand-visual inspection

"God Help Me if This Is a Dud" is no empty fear when an American fighting man throws lead at the enemy. His ammunition must be high quality. Guardian of that quality in Ordnance plants is visual inspection illustrated here

ated expeditiously though with meticulous conformity to the detailed provisions of its plan.

While all of the results I have cited from the proper operation of a well-designed quality-control plan will obviously redound to the immediate benefit of the manufacturer, these results also make it evident that it is distinctly to the advantage of the Ordnance Department for its manufacturers to have the quality of their products in control, particularly in these days when output of satisfactory matériel is all-important.

Ordnance inspections for acceptance may hence be so well planned that they will encourage manufacturers to get their quality into a condition of statistical control. The evidence, which control at a satisfactory level provides that quality is acceptable, is a perfectly sound basis for reductions in the volume of acceptance inspection. Such reductions cut down the amount of finished product awaiting acceptance, which the manufacturer must keep around in his own way; they eliminate the provision he must make for housing such material; they correspondingly reduce his inventory; and they enable him to get his money back more quickly. This sort of encouragement to control can thus be made quite persuasive to the manufacturer. At the same time the Department must be wholly impartial in its inspection and acceptance of good Ordnance matériel, regardless of whether or not the producer of such matériel uses any statistical approach whatever to his quality problem.

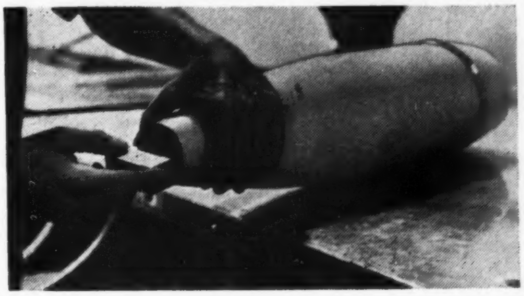
However, we like to look forward hopefully to a time when, for some types of matériel at least, manufacturers who have demonstrated their own dependability and sufficient quality control might possibly, with adequate Ordnance oversight of their inspections, provide *themselves* at least some of the quality evidence necessary to Ordnance acceptance of their product.

Some types of matériel, such as armor plate, for example, can only be inspected and tested on a sampling basis, and the sample is destroyed in test. Any sample at all thus consumes precious plate which we would much prefer to have on tanks or planes. Quality-control procedures make use of the continuing results from a succession of samples which individually can be extremely small in percentage as long as control is maintained. The

risk of accepting poor plate under these conditions can be held to substantially lower levels than would be possible with much larger samples and no quality-control procedure.

In approaching such a quality-control problem, we are requiring samples from every production lot of output for a time. As soon as the inspection and test results from a series of consecutive lots are uniformly within control limits, the manufacturer becomes eligible for a reduction in inspection. Continuance of such evidence of control would reduce the proportion of lots from which samples of the same size would be required, in successive steps, to a half, a quarter, and perhaps even lower. If the manufacturer loses control, he loses eligibility for reduced inspection, and it can only be regained by his regaining control of quality.

Now for the perennial question about the bad lots of product that might be accepted under this plan, before lack of control becomes evident. The answer, of course, is that without a control procedure, and even with perhaps larger samples from every lot, we would be just as likely, and perhaps more likely, to accept bad lots of product. So even in those



A T-shaped gage is used to measure the amount of amatol poured into a shell. Too much or too little won't do. Gages insure that good shells pass for shipment and poor ones are rejected for reloading

Weighing in for the big battle, loaded shells step on the scales just like the fighters they are. The operator classifies this 155-mm shell to determine range table

rare instances where there is no urge to reduce inspection, the application of control criteria to the existing inspection procedure will reduce the risk of accepting bad product. At the same time we acquire a means for determining what that risk is, so that we can decide whether or not we are inspecting as thoroughly as we should.

This whole question of defective material is something like a boil on the back of a man's neck. The amount of attention the man devotes to it is out of all proportion to the comparative weights of the boil and of the rest of his body. The worse the boil gets, the greater this disproportion. But once the poison gets out of the boil and it is reduced to the small-pimple class, it demands less and less of the man's attention.

If the defective material produced by a process approaches boil proportions, it won't do any good merely to pick at it with your inspection finger-

nails. You can't "inspect" into a product quality that was not put there by the manufacturing process. The manufacturer has just got to find the source of the poison and correct the process. Once he gets the boil reduced to pimple proportions, he can keep his eye out by inspection means to make sure it doesn't get bigger again.

We have no intention of allowing the Ordnance inspector to become a sieve for weeding out defectives from the product of a low-quality manufacturer. That is the manufacturer's job. But we will help him to get the quality of his product under control at a satisfactory level by advising with him and by making constantly available to him all information as to levels and trends in his quality which may be evidenced by Ordnance inspection results on his product.

The principles necessary for immediate use of quality control can be presented to the average layman of reasonable education in such language that he can understand and use them without his necessarily taking the time to delve into all of their theoretical bases and refinements. The average inspection supervisor can certainly acquire in short order the habit of plotting his experience with a particular product against time or against output; of putting simply computed limit lines on his chart; and of noting significant quality trends or departures from the proper levels. He can certainly be taught that some all too commonly used sampling inspection procedures accept product which does not differ significantly in quality from that which they reject; that there are procedures, often requiring less inspection, the use of which will largely reduce the amount of good material rejected and at the same time will improve the over-all quality of the material which he accepts; and what is the general nature of these latter procedures.

Some commonly used sampling inspection procedures appear to have been invented by men who have never played poker. If you draw a five-card hand from an honestly shuffled, honest deck, none, some, or all of the cards in your hand may be face cards, of course. If your hand contains no face cards, you certainly cannot conclude that the deck contains none. Yet I have seen cases, and Ordnance inspectors are far from the worst offenders, where ten per cent samples were being drawn from containers of fifty piece parts (that's about the same as a five-card hand from a fifty-two card deck), and a container was being rejected as soon as a defect was found in its sample. The accepted containers were probably just about like the rejected ones of course. That sort of thing just isn't necessary.

Handling Night Calls at a Dial PBX

By W. M. BEAUMONT
Switching Development Department

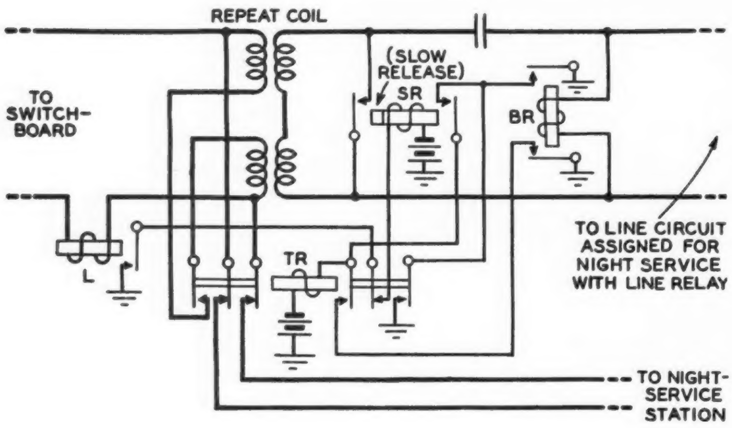
IN LARGE dial PBX's, incoming calls from a central office are usually completed by an attendant at a manual switchboard or cabinet. These manual positions are not ordinarily attended at night, since after business hours there are few if any incoming calls. It is common practice, however, for the switchboard attendant, before leaving for the day, to connect some or all of the central-office trunks to certain designated lines, where any incoming calls may be received. These night connections are made by plugs and jacks at the 701 PBX[1] and by keys at the 740 PBX[2], which are two widely used PBX's standard in the Bell System. For some time a need has been felt for more extensive use of outside trunks when the manual board is not attended. To make this possible with these two PBX's, a new night-service circuit has been developed that permits any of the PBX lines to be reached at night instead of just those plugged up at the switchboard.

This night-service circuit has three branches: one appears at a jack at the switchboard, and into this jack one of the incoming trunks will be plugged at night; another branch runs to the PBX switching apparatus, and is assigned a station number; the third branch runs to some station assigned to answer incoming calls at night. Very commonly this station will be a watchman's telephone, equipped with two or more lines as in the 1A key telephone set[3] or equivalent equipment, where any of the lines can be "picked up" and "held." The watchman answers all incoming calls, which reach him by way of this circuit. He determines the number wanted, places a "hold" on the calling line, and then dials the line wanted over another line associated with his set. The watchman then tells the called party that there is an incoming call for him, and to dial the night service number. The watchman then hangs up, thus releasing the step-by-step switches through which his connection was established. Dial tone is then received by the called station, and the number of the night-service circuit may be dialed. When this circuit is reached, the watchman's station is automatically disconnected, and conversation may proceed between the outside line and the called station.

The means by which this is accomplished is shown in the accompanying illustration. At the left, the circuit runs to the PBX switchboard, where at night it is connected to a central-office trunk. At the upper right, it runs to the PBX connector bank, where it may be reached by any PBX station dialing the proper number. At the lower right, it runs to the station that is to handle incoming calls at night, and here incoming calls may be answered and "held." An incoming call will ring the bell at this station, and when the handset is lifted to answer the call, relay L

[1] RECORD, *Sept.*, 1929, *p.* 36. [2] *Aug.*. 1928, *p.* 399. [3] *June*, 1940, *p.* 315.

operates on the resulting flow of current, and operates relay SR through a back contact on TR. The operation of SR closes two contacts: one placing a "short" across the side of the circuit the called subscriber will ultimately



Circuit for handling night calls at a dial private-branch exchange

reach so as to prevent clicks from being heard by the calling subscriber as the connection is being established; and the other establishing a path through which relay TR will later be operated.

The watchman determines the number wanted, holds the incoming trunk, dials the wanted number, asks the person answering to dial the number assigned to the night-service circuit so as to pick up the outside call, and then hangs up. The hold condition still persists, however, and so relays L and SR remain operated. When the called station reaches the night-service circuit as a result of dialing, relay BR is operated, and remains operated until the called station hangs up. The operation of BR closes two contacts: one to operate TR through a front contact of SR and one to hold TR operated after SR releases. When TR operates, it opens the circuit to the night station, opens the circuit to SR so that it will release to remove the short-circuit across the line, and closes the circuit at the central-office side of the repeating coil so that conversation may proceed. When the called station hangs up, relays BR, TR and L will release, thus restoring the auxiliary line circuit to normal.

The basic purpose of this switching procedure is to permit incoming calls to be completed to any station of the PBX. Outgoing calls from restricted stations must also pass through the night station attendant for completion. If, for example, a restricted PBX station should dial the number of the night service circuit in an effort to make an outside call directly, relay BR would operate, but relay TR would not because its operating circuit is open at the contacts of SR. As a result the outgoing trunk circuit is open at the mid-point of the repeating coil by the open contact on relay TR, and the attempt to call the central office is blocked. The night-service circuit, however, enables the watchman to place outgoing calls when requested to do so by the station users. After receiving the details of the call from the calling party, the watchman originates the call, and when the called party answers, requests him to hold the line. He then operates a "hold" key to hold the outside call, and calls the PBX station to tell the calling party that the station called is connected to the night-service circuit. The calling party then dials the night service number to complete the connection.

A PBX may be equipped with as

many of these night-service circuits as are needed to handle its incoming night traffic. Each circuit will require a line to the night attendant's station, a PBX line number assigned to it that may be dialed, and an appearance at the switchboard. Other methods of providing equivalent service are being studied, but this is being standardized at once to meet immediate demands.

Contributors to this Issue

G. D. Edwards entered the Bell System in 1913 on graduation from Harvard. After a year at Hawthorne he took up transmission work at the Laboratories, and in 1920 he went to Sweden as transmission engineer and later as chief engineer of the Stockholm-Gothenburg cable project. Returning in 1924, he entered what is now the Quality Assurance Department; later he became its head. His work there is described in the following excerpt from his Cleveland talk:

"Until now my business life has been with the Bell Telephone System where we have a continuing acceptance inspection problem rather similar in character to that of the Ordnance Department. I have been fortunate enough to have been closely associated with this problem in the Bell System for fifteen-odd years, and to have been responsible for its general guidance at headquarters for the past ten to twelve years.

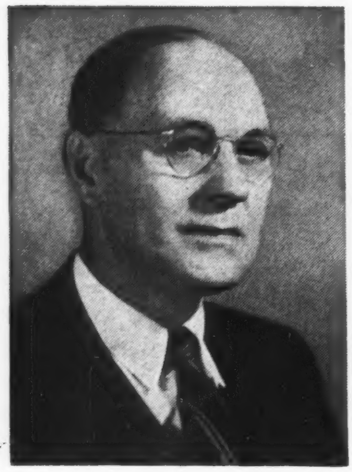
"The increasing difficulty of inspecting 100 per cent or even large percentages of the quantities of certain types of apparatus which the Bell System was using practically forced us into the beginnings of quality-control acceptance procedures as early as 1923. Not only were the economies of these procedures soon evident, but we found that under some circumstances we could secure noticeably better quality by their use than by 100 per cent inspection. The application of quality-control techniques in the telephone industry has thus grown to a point where we now tend to insist upon reasons for not using them, rather than on reasons for using them."

J. G. Motley

Following graduation from Webb Institute, where he specialized in marine engineering and naval architecture, J. G. Motley entered the student course of the Western Electric Company at Hawthorne. After the usual shop training and installation experience, he was assigned to the Physical Laboratory of the Engineering Department at New York but left a year later to serve with the U. S. Army at the Mexican border. During most of World War I he was in France with the Field Signal Battalion of the 27th Division.

Upon his return from France in April, 1919, he was first with the machine switching design group and then with the Radio Development Department on the installation of broadcasting equipment. Late in 1922 he transferred to the Plant Department where he engaged in plant operation and construction work. Since the fall of 1939 he has been Construction Engineer of the Murray Hill Project.

W. M. Beaumont entered the Bell System as substation installer with The Bell Telephone Company of Pennsylvania



W. M. Beaumont

F. J. Biondi

A. C. Walker

early in 1911. After a short time he transferred to the Maintenance Department and remained there until 1919, when he joined the Western Electric Company. With the Circuit Laboratory he has participated in the development of manual central offices and private branch exchanges. At present he is engaged in the development of both manual and dial private branch exchanges. He is a graduate of the night school of the Drexel Institute of Technology, Philadelphia.

F. J. BIONDI joined the Technical Staff of the Laboratories after he graduated from Lehigh University in 1936 with the B.S. degree in Chemical Engineering. He also attended graduate classes at Columbia University where he attained the M.S. degree in Chemical Engineering in 1940. As a member of the Chemical Laboratories he has been working on research problems to adapt synthetic plastics to communications uses. Recently he has been engaged in war work.

A. C. WALKER studied two years at the University of Colorado and then went to the Massachusetts Institute of Technology where he received the S.B. degree in Chemical Engineering in 1918. He spent a year in the chemical warfare service and two as a research chemist for a paper mill and a firearms plant. Then he went to Yale University for graduate study in Physical Chemistry and received there the Ph.D. degree in 1923. Dr. Walker came to the Laboratories that year and has since worked on research problems relating to paper and textiles. In this connection he has contributed largely to the development and application of methods for purifying textile insulation and for the inspection control of commercially purified textiles used in telephone apparatus. He is now engaged part time in electro-chemical research. Dr. Walker is a member of the Research Council and Board of Directors of the Textile Research Institute.